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Efficient Blasting in Metal Mines

By A. E. Anderson

Blast Roasting Silver Ores in Bolivia

By Robert D. Ferron

Marketing of Aluminum

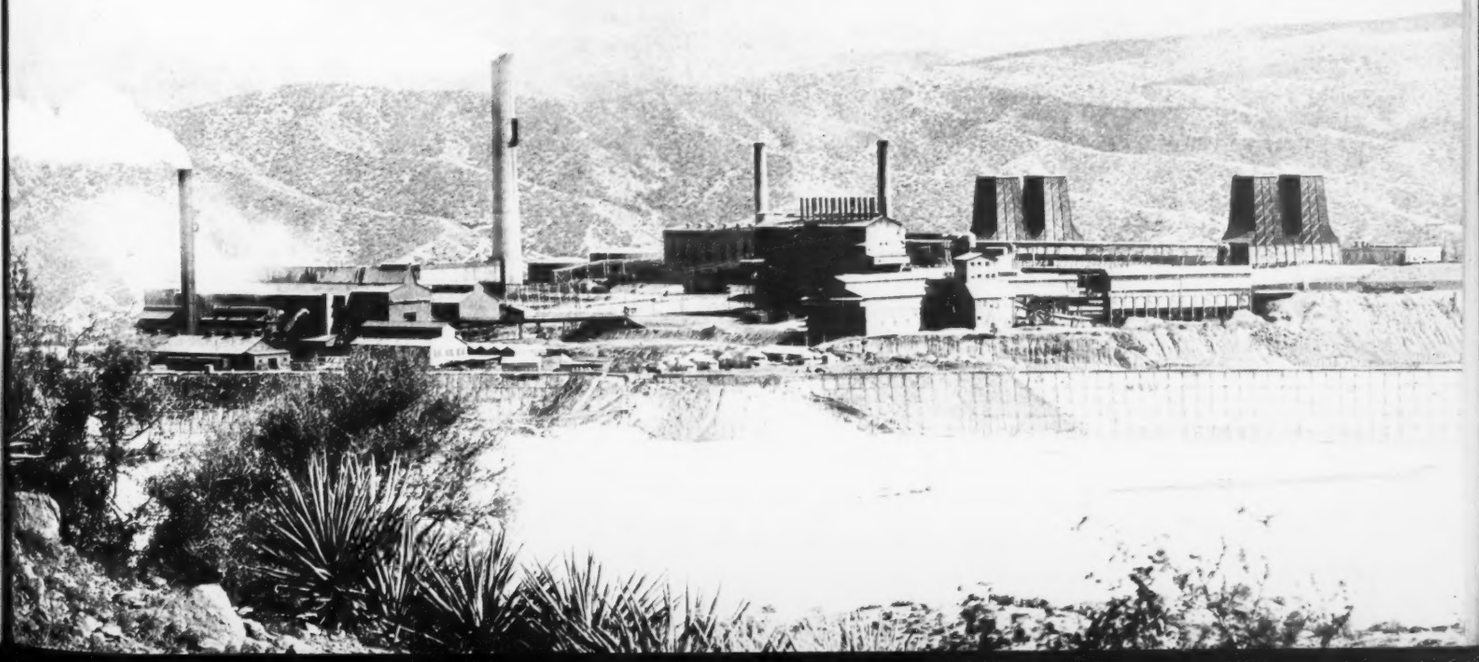
By A. H. Hubbell

Mine Cost Accounting

By Irving H. Wentworth

Biography of Henry H. Armstead

All the concentrates from Inspiration, Miami, and the mills near Globe are smelted here



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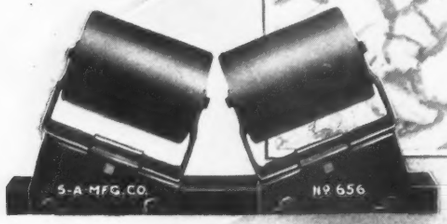

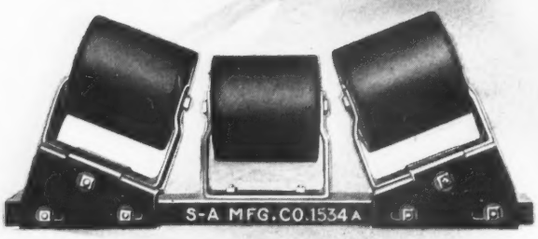

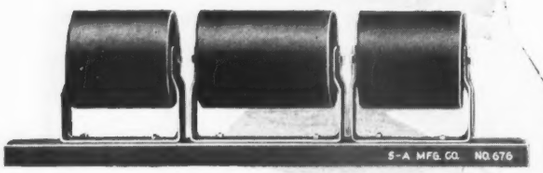

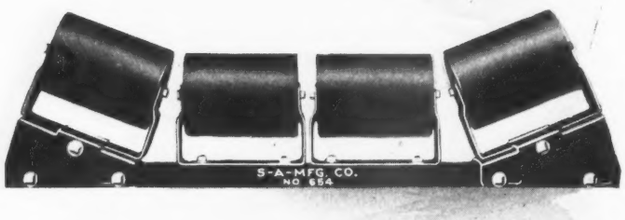

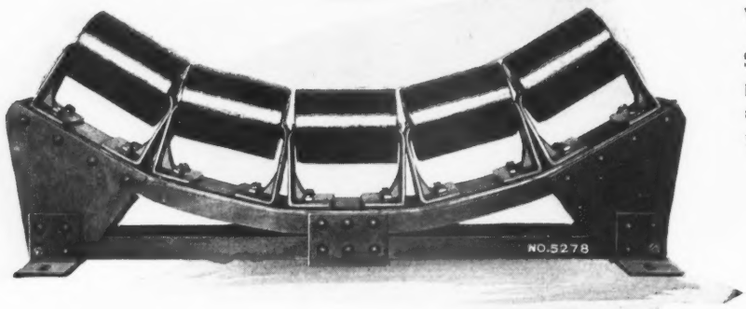

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ENGINEERING AND
MINING JOURNAL-PRESS

JOSIAH EDWARD SPURR, Editor

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Prodigal Sons

THE CRY that the petroleum reserves of the United States are being depleted at an alarming rate and by ruinous and piratical methods has been raised again, this time by one of the best known of oil operators and public utility operators—Henry L. Doherty, a very successful engineer and banker. This call was sounded by Mr. Doherty in an address before the Petroleum Marketers' Association in Cleveland on Nov. 19 and was couched in clear language. Mr. Doherty points out that when an oil pool is discovered, everybody that has a square foot of land has the right to drill a well, and since all well owners are tapping the same reservoir, decent thrift and economy are thrown to the winds in the endeavor of each to get all he can before the pool is exhausted, as it is with unnatural speed, on account of this riot of wastage. "Oil and gas," Mr. Doherty says, "belongs to the man who can capture it" (referring to the above condition) "and this means that we have absolutely no control over our production." And he cites a striking parallel: "The only other property, or product from property, which is under laws similar to the laws governing the production of oil, is wild birds and wild animals, and what has happened to them is rapidly happening to our oil." Petroleum, then, is going the way of the buffalo. But Mr. Doherty did not make the case strong enough. Wild birds and animals are now protected by game laws from extermination: not so, petroleum. Mr. Doherty says:

"According to the U. S. Geographical Survey, the remaining petroleum reserves in this country are approximately 9,000,000,000 bbl. Last year we took from the ground approximately 750,000,000 bbl. We are devastating the reserves in this country at a rate which would exhaust them in about twelve years."

Is Mr. Doherty an alarmist, a pessimist? Many would like to think so. Many have so intimated when the same alarm was sounded some years ago in various quarters, and, very especially, as regards the press, in the editorial columns of the *Engineering and Mining Journal-Press*. Or are those selfish who grin and shut their eyes to what is so swiftly coming to pass?

It is something more than a coincidence that at the Forest Conference held in Washington on the same day President Coolidge, in his opening speech, sounded much the same solemn warning regarding the waste and devastation of our forests. President Coolidge said, in his precise, dispassionate way:

"Expressed roughly, we have left about 745,000,000,000 cu.ft. of timber. From this the annual drain is 25,000,000,000 cu.ft. This total drain is most significant when we reflect that, toward offsetting it, we have an annual timber growth of only 6,000,000,000 cu.ft.; and even in our young forests, where this growth is taking place, cutting has already outstripped growth. We must face the situation that at this rate we are not far from timber exhaustion . . . There is no easy road out of this unprofitable situation. The end of free timber is in sight. World competition for the world supply will leave no large dependable source of imports open to use. The use of substitutes hardly keeps pace with new uses for wood. There is no likelihood that we can become a woodless nation even if we wanted to. When the free timber is gone we must grow our wood from the soil, like any other crop."

The resource of growing timber as a crop—a crop which takes twenty to a hundred years to mature—is a poor consolation; but this avenue is not open to petroleum, which is even of greater importance to the country than forests.

Finally, if we turn from petroleum and forests, to the metals, we find the same feverish destruction going on—mines being exhausted and abandoned with bewildering speed, so that we are already sensing approaching shortages of many of the metals—a situation which the editor of *Mining Journal-Press* recently stressed in an address in Cambridge before the Boston Section of the A.I.M.E. Here, again, are conclusions unpleasant to face. We are a great and rich people. Did we not do all this ourselves—do we not rightfully pat ourselves on the back for having produced all this petroleum, lumber, and metals? Must we acknowledge that not Americans, but obscure "Nature" has done this: that we are more lucky than remarkable? At any rate, this uncomfortable thing is true. We are the prodigal sons, wasting the family estates, so that not only our children will be poor, but we may live to feel the pinch ourselves. Once a full conviction of the truth reaches us, many will be public-spirited enough to demand some public trusteeship of the estate. Mr. Doherty has been patriotic enough to do it for oil: the President and the representatives of the lumber industry, who met in Washington, are trying to do it for our forests. We have as yet no wide sense of that public obligation as to wastage of our metal resources, but, knowing the type of our fellow citizens, we know that eventually it will come. Let it not come, for the petroleum and the metals, too late; when our mineral resources have gone the way of the buffalo, but which cannot, like the buffalo, be bred back.

The Spirit of the Southwest

ONE REASON why improvements in metallurgical methods are made in rapid succession in the mining industries is because of the liberal manner in which technical information is generally exchanged. We have often contended that this policy bears sweeter fruit than an attitude of secretiveness or technical selfishness. If any demonstration of the soundness of this contention is required let the reader visit Arizona—the leading copper-producing state of the Union—and observe the splendid co-operation which mill superintendents and other operators give each other there. Arizona has undoubtedly the finest copper concentrators in the world today. They are the last word in modern ore-dressing methods as applied to low-grade sulphide and oxide ores. They are open freely to interested engineers for study and inspection. The men who run them have contributed extensively to the technical press de-

scribing their work and the results obtained. They also manage to keep well posted upon the work of other plants, frequently visiting them and discussing kindred problems with their operators. This contact is naturally very valuable for it avoids duplication of experimental work. Thus, one mill in the Southwest is now experimenting with cubes in secondary grinding to learn if they are superior to other grinding media.

Nearly all the plants have been exchanging data on the results of their experiments with new flotation reagents, notably potassium xanthate and allied chemicals.

In one of the concentrators the addition of a new reagent to the flow sheet at the ball mills gave trouble further along the circuit. It seems that an excessive amount of colloidal matter was formed that interfered with classification and filtration. While discussing this effect with the superintendent of a neighboring concentrator this experienced engineer recalled a somewhat similar trouble in his unit and how he had overcome it merely by changing the point of application of the reagent in the circuit. He related his experience and made the suggestion that a change be made just as he had done. The suggestion was a happy one. Its execution quickly remedied the trouble.

Other examples of the fine spirit among the millmen in the Southwest might be cited but the one just mentioned is typical. Not that Arizona has any monopoly on the freedom of exchange of technical information. Other districts may be equally as liberal but in Arizona this attitude stands out prominently. In fact a metallurgical engineer from a large mine in Utah whose policy did not conform to the frank spirit of the Southwest, recently visited the copper mining districts of Arizona and was so impressed with the cordial reception he received that he remarked on leaving that thereafter any qualified engineer could have access to any information his company operations in Utah possessed. Evidently the spirit is contagious.

Colorado's Testing Laboratory

OUR EDITORIAL of Oct. 11 on the ore-testing laboratory at Golden, Colorado, where facilities for testing ores are publicly open to engineers, and where the director also can conduct tests in connection with his own private consulting work, has called forth a great deal of rejoinder and comment. This testing plant, it may be repeated, is kept open by public funds—it is a publicly supported institution for the benefit of the public. Therein lay the reason for our questioning as to whether the state had not gone too far with private business, a tendency which we called socialistic—a word, by the way, which to us has no derogatory meaning, although we are inclined to lean against the stream and hang tenaciously to individualistic methods, which are more and more submerged.

The commentators can be divided easily into two groups—one of which reprimands us for our opinion, and goes on record unqualifiedly as being in favor of the testing institution as it stands. These include many independent consulting engineers—many of the most prominent and thoughtful mining engineers of Denver have addressed a round robin letter to us going emphatically on record to that effect. The other, less numerous group, emphatically approve of what we suggested in our earlier editorial; and their views are stronger and more definitely opposed to the testing laboratory, as conducted, than were our tentative queries.

In general, it appears that the more numerous engineers who oppose our suggestion are consulting engineers who have no testing plants of their own; those who pat us on the back are those who have testing laboratories of their own, for which they are seeking business. One of them, whose letter we published on pages 824 and 825 of our issue of Nov. 22, recites that he competed for a job, with his private testing plant, against the director of the Golden laboratories, with his state-supported testing plant: and pertinently queries as to whether this is fair competition. It is purely—and properly—a case of differing self interest in the two groups. And that leaves us still in the judicial position, and still questioning whether it is best for the state to maintain a public establishment for the benefit of a section of the public. Frankly, we still think not. The principle is one that cannot be extended logically. The government should not enter into competition with private business; the average taxpayer would not approve of the burden, if he understood it. A little group should not put through legislation which will secure them a financial protection paid for by the public at large. The principle is not recognized as sound and fair.

The whole question of competition between consulting engineers who are wholly dependent upon themselves, and the group of subsidized or state-aided mining engineers has been alluded to briefly before and will demand more serious attention in the future.

Geology on the Radio

PROFESSOR J. EDMUND WOODMAN, of New York University, has been broadcasting talks on geology through station WJZ, New York City. They are talks to laymen. Those laymen who have heard them declare them interesting and sprightly. We extend our congratulations to Professor Woodman. The exercise of talking to the laity is one that should be encouraged. Geology needs salesmen to introduce its charms and philosophy to the people. Also, geologists would find this practice salutary to themselves: in many cases, if forced to talk in plain words, they would be astonished at the obscurity of their own understanding. Common sense and plain English are pressing needs.

Size of Orebodies

FROM TIME TO TIME the *Mining Journal-Press* will be glad to publish data upon the principal dimensions of important orebodies, not only those now being mined but those which were mined in the past. We are of the opinion that this information will be of considerable value and of general interest as well. We suggest that where an individual or the officials of a mining company send us this information, and we want them to do so, the points to be covered are the maximum length, average width, vertical range, dip and pitch. A sketch to scale showing a vertical section in the plane of the dip and also a plan of a horizontal section, at a significant point, upon which the principal rock formations are indicated would be useful. Where an orebody of importance has been mined out, a statement of the tonnage produced together with the total of contained metals will add greatly to the foregoing information. Let some of our friends start the ball rolling. We will take a hand ourselves for we believe that this information should be a matter of record.

A Study of Limestone Mining

FEW PEOPLE realize that limestone constitutes one of the major mineral products of the United States. Production figures compiled by the U. S. Geological Survey, though incomplete for 1923, are probably in excess of the 1922 total value of $68,000,000. If one adds to this the production value of lime and cement which are primary products of limestone, bearing somewhat the same relation to it that pig iron bears to iron ore, the total reaches the tremendous sum of $365,000,000, or a million dollars for each day in the year including Sundays and holidays. In production value, limestone leads all minerals except iron, coal, and petroleum.

For most applications, rock of a high degree of purity, or having a composition varying only within narrow prescribed limits, is required. Although limestone is widespread and abundant, deposits of the high quality demanded for many industrial uses constitute only a small percentage of the total. A multitude of open-pit quarries, many of them producing several thousand tons each per day, are required to supply the heavy demands. With this vast and growing production it is not surprising that excavations are becoming much wider and deeper year by year, and that high-grade limestone deposits at or near the surface gradually are being depleted.

The necessity for removing heavy overburden, or for working at great depths, is slowly forcing operators to adopt underground methods. At least thirty companies in various branches of the limestone industry have resorted to underground mining, and some of the mines are attaining a magnitude comparable with many metal-mine operations. At two mines the stone is hoisted through shafts between 400 and 600 ft. deep, and one cement company reports a length of 4½ miles of underground workings.

This tendency toward a profound change in methods in a fundamental industry of such magnitude demands greater attention by mining engineers. Many limestone operators could reduce production costs materially by changing from open-pit to underground methods, but they hesitate to venture on an uncharted sea without the aid of pilots. Few engineers are familiar with limestone mining methods, and no publications adequately covering the subject are available.

The U. S. Bureau of Mines has taken the first decisive step toward giving needed assistance to limestone producers who are already mining, or who contemplate underground operations. An engineer who has had successful experience in limestone mining has been engaged on the staff of the Nonmetallic Minerals Experiment Station at Rutgers University, to make a detailed study of underground methods, equipment, and costs. The data thus obtained, supplemented by knowledge gained from a varied experience extending over several years in other branches of mining, will be compiled as a report, which, it is expected, will constitute a textbook on the principles of limestone mining. Inquiries sent out by the bureau to many limestone companies in various parts of the country brought a response almost unanimous in favor of such a report.

An awakening interest in limestone mining is indicative of the mutual interest that exists between the metallic and the non-metallic mineral industries. Engineers as a rule regard the non-metallics as outside the scope of their activities, and similarly, too many of the non-metallic operators look upon engineers as unnecessary additions to their personnel. A closer partnership between mining engineers and the non-metallic industries would promote the best interests of each.

The Microscope in Studying Ores

RECENTLY we pointed out the adverse effect that the extreme devotion to microscopic work has had on the progress of geology. This appears almost paradoxical, for it is axiomatic that the discovery of a new tool like the microscope opens up new worlds to the scientist.

Yet there was a period after the perfection of the petrographic microscope when the professor took a suite of specimens into his laboratory and soon produced a monograph on the igneous history of the district. When one of our editors was studying in Berlin, an instructor informed him that he was working on a treatise on the igneous rocks of the Argentine and showed him the specimens which were to form the basis. Asked if he had been in the Argentine he replied brusquely in the negative. The specimens had been sent him. That period of petrology has happily passed, or is passing. Yet a similar stage is now seen in the study of ore deposits. The microscope is a great aid to the study of ore deposits; and study of opaque ores by reflected light is a necessity. It is, indeed, a method which has been used for decades, but with better apparatus more recently. Nowadays, a few specimens are all that is necessary, in many college laboratories, to decipher the ore deposit.

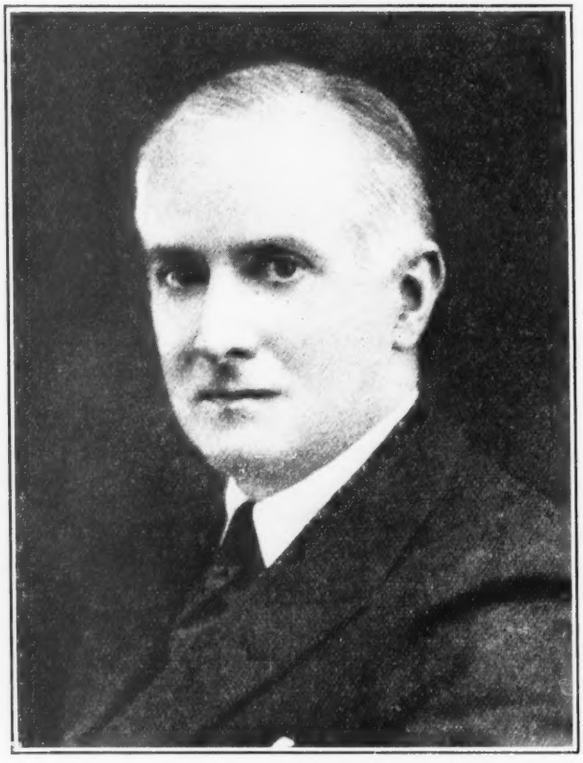
Our protest is against the practical elimination of all evidence except this one class of evidence, insufficient on account of the small scale on which it is exhibited. Careful observation in the mines with lamp, pick, rule, specimen bag and notebook, careful detailed mapping and assaying, careful study of the vein and its factors in the stope and in the broken ore which lies in the bins and on the dump, are the prime necessities for any study of ore deposits. This requires hard, arduous, and dirty work: it cannot be done at a desk in the laboratory. And herein is the reason why microscopic geology often has been assigned a solo rôle in recent papers on ore deposits. Methods have adapted themselves to university teaching and laboratory methods: and the result has often been prejudicial to advancement. We have no one university in mind, although many examples come up at once in that connection. At the same time, to a number of other universities this criticism cannot in any way be applied. But sometimes one gets the impression that the student is sent out with his microscope as the magic wand which enables him to dispense with field geology and read the innermost secrets of the rocks. Now, the criteria of microscopic geology are by no means definitely fixed, and cannot be trusted without field evidence. The reverse is also true.

Geological problems are so nice that all available evidence must be assembled from all sides, if the vision is to be left so far as possible unclouded. There is no especial virtue in evidence because it is microscopic; no special aristocracy in small scale. And when all the available evidence, small scale and large scale, is in, the geologist must arrange his data so as to get a true perspective of all, if he is to see and draw the picture. Overindulgence in microscopy to the exclusion or contempt of other evidence is prejudicial to a perspective.

Mining Engineers of Note

Henry Howell Armstead

HENRY HOWELL ARMSTEAD, miner, financier, and soldier, is notably one of those rare characters who work instinctively and quickly. Long before he definitely makes up his mind or analyzes his reasons, he knows or he doesn't. This useful quality in a mining engineer develops into a "geological sixth sense"—a valuable faculty to have in looking for ore, and one that has stood Colonel Armstead in good stead in many of his mining undertakings. Talache, a moderate-sized silver-mining camp on the western shore of the beautiful Lake Pend d'Oreille, in northern Idaho, owes its existence solely to his vision and industry. There he prospected a neglected and narrow but rich silver vein and brought it to a productive stage when speed was essential in order to take full advantage of the repurchase provisions of the Pittman Act. During this work he established what is probably a world's record for tunnel driving, and in doing so used gas masks, a war device, to expedite the work. He afterward equipped the mine with a model surface plant of which the whole Northwest is proud. Colonel Armstead has left his mark upon other places in North America. Armstead, Mont., was named in his honor years ago, while he was engaged in opening up central Idaho and southwest Montana. Upon leaving the School of Mines, Columbia University, in 1895 Colonel Armstead decided to strike out for himself, and most of his work has therefore been of a consulting nature. His first field experience was obtained in Cripple Creek, Colo., after which he transferred his activities to Idaho, near Yellow Jacket, where he erected and operated the first cyanide plant in that part of the country. Later he went to Butte, then on to Mexico—for eight years—only to return in 1912 to the Northwest, where he now lives. In Mexico he operated and examined mines in Chihuahua, Tepic, Guanajuato, Oaxaca, Sonora, and other states under the name of the Armstead United Companies. Practically all of his mining in Mexico was confined to silver, and this statement also applies to his ventures in other parts of North America. This year he founded the Canadian Mines Merger, Ltd., to work the Utica mine and allied properties near Kaslo, B. C. He is now working on a development of part of the Trout Lake mining district, in another section of British Columbia, a mineralized area of much promise. Recently the Armstead Snow Motor Co., of Detroit, which manufactures vehicles for use in snow-covered areas, was organized by Colonel Armstead. Another company bearing his name is the Armstead Soda Products of Laramie, Wyo., which will exploit a western deposit of high-grade silica, soda, and limestone for use in glass manufacture. In the World War Armstead was commissioned a major of engineers and has retained his interest in Army affairs, at present holding the rank of colonel in the Engineers' Reserve Section attached to the Thirteenth Engineer Headquarters at Washington, D. C. Colonel Armstead has also found time to devote to other activities outside professional work, especially national politics. He is a member of numerous clubs and professional organizations, among the clubs being the Columbia University, New York Yacht, Engineers, Bankers, Racquet, Lawyers, Calumet (New York); Metropolitan, Riding and Hunt, Army and Navy, Chevy Chase (Washington); University of Chicago; and Detroit, Denver, Colorado Springs and Spokane clubs. He also belongs to the Alpha Delta Phi Fraternity, the American Institute of Mining and Metallurgical Engineers, the Canadian Institute of Mining Engineers, the Pan American Society of the United States, the Society of Military Engineers, and the Sons of the American Revolution, and is interested in many other civic and political organizations, national and otherwise.



COLONEL HENRY HOWELL ARMSTEAD

Quiet and resourceful, Colonel Armstead has an enviable reputation for squareness and integrity which doubtless accounts for the intense loyalty of his friends. By nature he is a leader rather than a follower, and that he can lead successfully not only the financial direction of the mining enterprises in which he has been interested, but the labor that executes them, his record eloquently testifies.

Efficient Blasting in Metal Mines

Proven Practice in Drilling Holes, Selecting Explosive, and Conducting Operations

By A. E. Anderson
Mining Engineer, E. I. du Pont de Nemours and Co., Denver, Colo.

A. E. Anderson

MANY of the larger mining companies are now giving to their practice in the use of explosives the same amount of study that in the past they have given to the other operations. As a result, they have been able to increase the efficiency of their blasting to a marked degree. The resulting reduced costs and increased efficiency affect not only the blasting operation itself, but also subsequent operations, such as the loading of the ore from chutes into cars, the crushing of the ore for milling, and, in fact, the actual recovery of values from the ores.

In the old days, the work in the mines was done largely by the highest type of skilled laborers, who had been attracted to the mines by the romantic possibilities of discovering rich orebodies. Now the old lure of the mines is lacking and the ordinary type of labor must be utilized. Therefore closer supervision and a greater degree of specific instruction are necessary. Modern labor is specialized. We must hire a machine man to drill the holes, timbermen to do the timbering, common laborers to muck and tram the ore; and we can seldom depend on one to do the work of another. In many operations men must be trained to do the more skilled classes of work.

Development in Other Phases of Mine Operation

Machinery is rapidly replacing hand work in the mines. Hoisting engines, haulage motors, and air drills are standard equipment. Now mucking and loading machines are rapidly replacing hand shoveling in tunnels and drifts. Scrapers, drags, conveyors, and other mechanical equipment are being developed for stopes. Soon we may even see orange-peel buckets being used for digging the muck out of the bottom of shafts.

But explosives still are the only practical and satisfactory equipment for breaking rock. Various types of mechanical devices have been tried, but none successfully. No mechanical equipment will stand up—"That which destroys nature is in itself destroyed." The solid and liquid compounds that make up explosives are detonated to form gases, and this chemical change develops instantaneously sufficient force to shatter the hardest rock and force it from nature's grasp.

In many mines the blasting practice remains the same since dynamite was first used for blasting rock. In metal mines, most miners demand and receive 40 per cent dynamite because that is what they have used before, and not because that has been tested and proved to be most efficient for the rock to be broken. They usually want gelatin dynamite, because it is plastic, water-resisting, and practically fumeless; but send them outside on some other kind of work, and they want the same thing.

The ordinary miner knows little about the various kinds of dynamite, nor does he know the particular properties of each kind that make it suitable for certain conditions and kind of rock. As a matter of fact, miners should not be expected to know this, as a complete and up-to-date knowledge of various kinds of explosives, their properties and adaptabilities, is specialized technical information that can be obtained only by continual access both to the results obtained in practice and also to data respecting developments in the laboratories.

Theory Vs. Practice in Blasting

The application of theory to practice is difficult in using explosives. The development of formulas for blasting is impracticable, for the following reasons:

1. Because of the difficulty of measuring the actual force produced by an explosive. The strength, velocity (rate of detonation), temperature, and volume of gases produced can be measured as can other factors that influence the results; but the actual force produced cannot be measured in or expressed in pounds per square inch, or in any other unit that we can use to calculate charges.

2. Because it is impossible, in most operations, to determine with any degree of accuracy just what the strength of the burden on a bore hole may be. That is, we cannot measure or express in foot-pounds, or in any other unit, what strength we have to overcome by the blast. We can, by tests on small pieces, measure the crushing strength, shearing strength, and tensile strength of a certain rock, but no combination of these figures will give us the figure we need to calculate a charge for blasting.

3. Besides the factors noted, local conditions and variations affect greatly the resistance of the rock. So that, even if we could get the above recorded factors for solid rock of a certain kind, the cleavage and fracture as well as the size of the opening blasted and other things would make the figures inaccurate, to say the least.

4. No theory would tell us the limit to the depth that a round of holes would break. In practice we find that the economical depth to which a round of holes will break in hard ground is about the same as the smallest dimension of the opening. For instance, in a 5 x 7-ft. drift, it is not practicable to break more than a 5-ft. round in hard rock. Of course, the depth of round that can be drilled and shot in one shift often is a factor.

The facts above set forth do not imply that the charging of bore holes is mere guesswork, but the estimates must be based upon previous experience under

similar conditions. Therefore, previous experience and judgment is necessary in the satisfactory use of explosives. Some men have extensive experience, but never acquire judgment. Good judgment can only be developed by a close observation of conditions and results.

In starting new work, the first shots are judged by previous similar experience elsewhere. Then the results of the first shot can be used as a basis of calculation for subsequent shots. In some kinds of work accurate calculations can be made. For instance, in quarry work where we have horizontal strata with a straight and vertical front face we can drill a line of holes a certain distance back from the face and a certain distance apart. The first blast is usually loaded by someone with previous similar experience and then subsequent charges can be estimated to the fraction of a pound of powder per cubic yard of rock. The kind of explosive must, of course, be selected by someone with the necessary knowledge and experience, and the correctness of his judgment verified by results. The same practice can be followed in less uniform conditions.

Obviously, the first requirement in successful operations is a detailed knowledge of the material to be worked, the conditions of operation, and the results to be obtained. In recent years the nature of rock or ore to be blasted has been investigated in great detail with paying results. Large mining companies have made studies of the hardness, toughness, fracture, and all other features, and then used these facts as a basis for classification of the rock or ore. Then they have studied the drilling of the holes, various types of rounds, loading of the holes, and rotation of shots; and then, from the results obtained, they have standardized their practices in each mine. They claim to have cut their costs from 25 per cent to 35 per cent as a result of the increased efficiency obtained from these standardized rounds and the use of stemming in the holes.

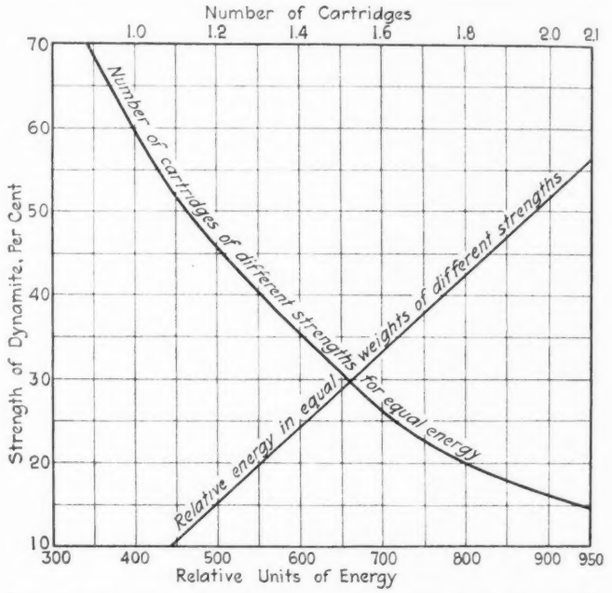
There are certain well-established qualities that are worth careful consideration, as they have an important bearing on the choice of explosives. These may be accepted as axiomatic.

A. The quicker the explosive, the greater the shattering effect; that is, the more rapid the rate of detonation, the more nearly equal the force in all directions. And the slower the explosive, the more it tends to seek the easiest outlet for its force. The old saying that "dynamite works downward and black powder upward" is true, but is not the whole truth, and is, therefore, misleading. Dynamite works equally in all directions. Black powder is slower and has time to seek the easiest outlet.

B. The more an explosive is confined, the greater its efficiency. That is, the more nearly the resistance is equalized in all directions, the greater are the results produced. Thus, an explosive perfectly confined in the exact center of a cube or sphere will give the greatest possible efficiency.

C. The noise produced by an explosive is wasted energy. That does not signify that all blasting should be done noiselessly, because in some classes of work it is obviously impossible to make the confinement so perfect that noise is eliminated. For instance, in "mud-capping" or "plastering," where the explosive is simply placed upon the top of a rock and covered with mud, the effect must necessarily be only a small part of the force produced, and the rest is expended in the air, producing concussion. But unless we want noise or concussion, we should use this kind of blasting only where the saving of time in other work, such as drilling of holes, will more than compensate for the loss in the efficiency of the explosive.

D. Safety is efficiency. In other words, it is more economical to take more time and use more material in using a safe method than to take a chance to save



Curves showing effectiveness of one kind of dynamite, but with various strengths

a little time or money. "Safety first" is not merely a matter of sentiment, but pays large dividends in cash as well as in personal satisfaction and well-being. Taking chances with explosives is expensive in the end, and risks the life of yourself and your fellow worker.

E. Dynamite of 40 per cent strength is not twice as strong as 20 per cent strength; neither is 80 per cent double the strength of 40 per cent. In practical work, 80 per cent may do ten times as much as 40 per cent; indeed, the latter may be too weak to do any satisfactory work. Again, 20 per cent may do as well as 40 per cent or 80 per cent, on account of the rock being soft and not needing a strong explosive. Also, a certain strength of one kind of dynamite may do much more work than the same strength of another kind, owing to the fact that the former is more suitable in other ways than the latter.

F. The following table shows the number of cartridges of any given strength required to equal in energy produced one cartridge of any other strength of the same kind of explosive:

Equivalents of Dynamite of Different Strength

One Cartridge Per Cent	Per Cent								
	60	50	45	40	35	30	25	20	15
60	1.00	1.12	1.20	1.28	1.28	1.50	1.63	1.80	2.08
50	0.89	1.00	1.07	1.14	1.23	1.34	1.45	1.60	1.85
45	0.83	0.93	1.00	1.07	1.15	1.25	1.36	1.50	1.73
40	0.78	0.87	0.94	1.00	1.08	1.17	1.27	1.40	1.59
35	0.72	0.81	0.87	0.93	1.00	1.09	1.18	1.30	1.50
30	0.67	0.75	0.80	0.85	0.92	1.00	1.09	1.20	1.38
25	0.61	0.69	0.74	0.78	0.85	0.92	1.00	1.10	1.27
20	0.55	0.62	0.67	0.71	0.77	0.83	0.90	1.00	1.15
15	0.48	0.54	0.58	0.61	0.66	0.72	0.78	0.86	1.00

G. The curves on this page show the relative energy contained in equal weights in dynamite of various strengths, and the number of cartridges of different strengths required for equal energy. The table gives the same data as the latter curve.

Characteristics of High Explosives

Kind of Explosive	Strength, By Bulk	Per Cent By Weight	Water Resistance	Quality of Fumes	Velocity, Feet per Second	Suitable Use and Remarks
Straight N.G. dynamite	15 to 60	15 to 60	Good	Poor	8,000 to 18,000	Quarry and ditches. Low freezing.
Ammonia (RCX) dynamite	20 to 60	20 to 60	Fair	Fair	8,000 to 16,000	All outside dry work.
Gelatin dynamite	25 to 90	25 to 90	Excellent	Best	8,000 to 22,000	Underground, wet and tight work.
Blasting gelatin	100	100	Perfect	Best	24,000	Wet and extremely hard work. Elastic.
Dumorite dynamite	20 to 40	30 to 60	Fair	Fair	8,000 to 18,000	Outside work. Non-freezing. Granular.
Nitrate of ammonia explosives	25 to 40	50 to 70	Poor	Fair	6,000 to 11,000	Permissible powder for coal mines and dry outside work.
Nitroglycerine permissibles	15 to 25	17 to 30	Fair	Fair	6,000 to 10,000	Gaseous and dusty coal mines.
Trinitro-toluene (TNT)	50	50	Poor	Poor	16,000 to 20,000	Outside dry work. Non-freezing powder.
Picric acid	50	55	Poor	Poor	16,000 to 22,000	Outside dry work. Non-freezing powder.

Standard Is 40 Per cent Nitroglycerin

H. The strength of any high explosive is rated by the use of 40 per cent straight nitroglycerin dynamite of a certain composition, as a standard. Therefore, other dynamites do not necessarily contain 40 per cent of nitroglycerin just because they are marked 40 per cent strength. Either stronger or weaker substitutes are used to replace part of the nitroglycerin, so as to get certain other qualities that are desired in the explosive.

To secure efficient results in the practical use of explosives in blasting operations it is necessary to give careful consideration to the following points:

1. The selection of the explosive best suited for the work; that is, the proper kind or class of explosive.
2. The selection of the most satisfactory strength.
3. The proper drilling of the blast holes in the rock.
4. The correct charging of the blast holes.
5. Thorough stemming of the blast holes to insure proper confinement of the explosive.
6. Accurate detonation of the charges in the correct sequence.

Selection of the Explosive Is Important

It is most important that the proper kind of explosive to suit the conditions and requirements of the work to be done be selected. When there was only one kind of dynamite and one kind of black powder, it was easy to decide what to use. But there are now a great many kinds of high explosives and several kinds of low explosives. They vary in bulk, velocity, water-resistance, density, hardness, quanity of fume developed, and physical characteristics. The development of new explosives has been rapid, and it is difficult for even the specialist to keep up to date when he has the information the manufacturer can supply as well as opportunity to study blasting operations.

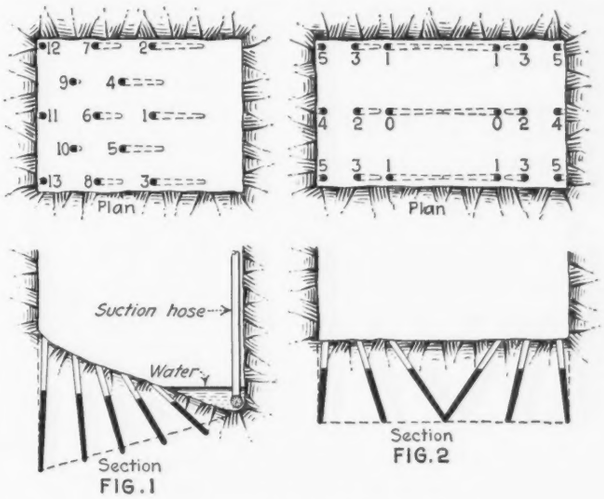
On account of the variation in bulk, the same size stick of an explosive of one strength and of one kind will often develop the same force or blasting effect as another kind of powder of greater or lesser strength. The accompanying table of the characteristics of the common high explosives can be used as a basis for selecting an explosive that has the desired properties.

The information on the last two explosives is not accurate, but is sufficient for practical purposes.

The location, size, and angle of the holes, as well as their relative position, is probably the most important single factor in successful blasting. The one governing rule is that each hole should be well balanced and have the best possible chance to break, either by itself or in conjunction with others that are to explode previously or simultaneously. This matter deserves considerable attention and should be carefully worked out. Advantage should be taken of every natural condition, but not to the extent that if the condition varies the round will fail to break.

In many operations the type of round drilled is adopted because it is easy to drill, and not because it has been tried out and found to be the most efficient. Practice varies considerably in tunneling and drifting, but in shaft sinking drill rounds are well standardized. Stope rounds are usually devised to fit local conditions of width, dip, hardness of ore, and other governing factors. Raise holes are usually the most difficult to drill, owing to the inconvenience of holding the drill machine in the desired position to get the right angle on the holes.

Referring to Figs. 1 and 2, the "end" cut is usually



Drill rounds for shaft sinking

Fig. 1 shows the "end" or "sump" cut. The "V" cut, Fig. 2, is used most frequently

used in small shafts, but the *V* cut is most common. Both of these may be shot with either fuse and caps, but electric firing, by means of electric blasting caps and delay electric blasting caps, is by far the most satisfactory, both from a safety and economy standpoint. The holes are fired in the order indicated by the numbers. The numerals in Fig. 1 refer to one shot being fired at a time; those in Fig. 2 refer to group firing with delay electric blasting caps with five delays. However, sometimes, all the cut holes are fired simultaneously with electric blasting caps.

The most common type of round used in ordinary mine drifts is the "down" or "draw" cut. This works well in easily broken ground and is the most simple kind of round to drill, where the muck is loaded at the same time the round is being drilled. That is because all the holes, except the three lifters, are drilled from a crossbar at the top or from the top of the column. This eliminates interference between the drilling and the mucking.

In harder ground, however, the tendency is for this type of round to fail to break at the bottom. Thus, each successive round is harder to break than the previous one. See Fig. 3. After one or two rounds the

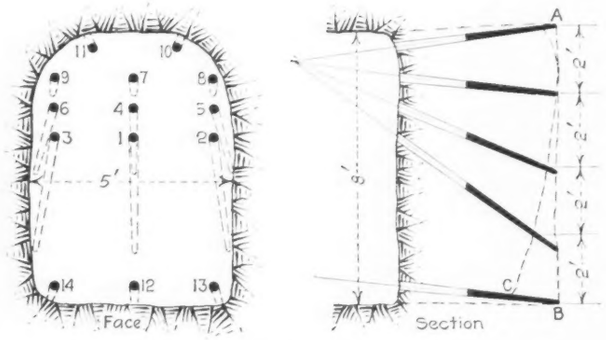


FIG. 3

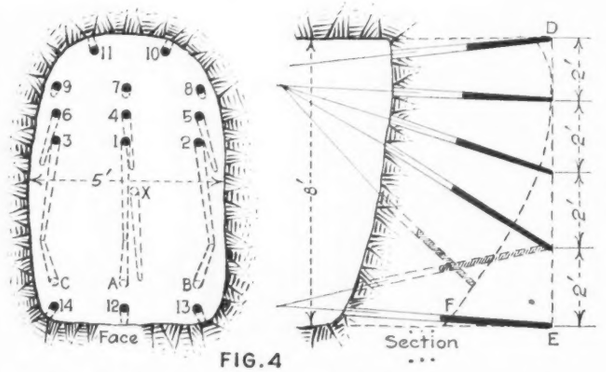


FIG. 4

Usual drill rounds for small drifts and crosscuts

Fig. 3 serves well in medium rock. Fig. 4 is better when the rock is hard. Extra holes, *X*, *A*, *B* and *C*, may be necessary.

face is as shown in Fig. 4. Then, usually an extra cut hole, as *X* is drilled. However, this does not make a square face either. The best way to prevent this is to drill hole *A* in Fig. 4, or if necessary, also *B* and *C*. If hole *A* is drilled in each round it usually insures the satisfactory breaking of the round. As the rock becomes harder and harder, it is necessary to add *B* and *C* to insure a break. This is sometimes called the efficiency round.

"Diamond" Cut in Hard Rock

Fig. 5 shows a "diamond" cut, sometimes used in extremely hard rock in small tunnels. Fig. 6 is sometimes used in medium hard rock and Fig. 7 in soft ground that breaks well with a top cut. This is sometimes used in drilling drift rounds with a stoper drill.

Referring to Fig. 4 and Fig. 3, the reader will note that the angle the cut hole makes with the face is 50 deg. This is too great an angle to break well in hard rock. This angle should not be more than 45 deg. to break bottom. But if two holes join, as *A* and 1 in Fig. 4, the angle of the holes with the face can be much greater than when one cut hole is fired at a time. Of course, it is necessary that these two holes be fired simultaneously. This can be accomplished either by drilling the holes so that they come together at the bottom, or they can be shot simultaneously by means of electric blasting caps. Electric blasting is being used more extensively every day, especially in wet tunnels and extremely hard rock, where positive detonation and correct sequence are essential.

In driving tunnels or crosscuts that are larger than the standard 5 x 7-ft. mine drift, the "combination" *V* and "down" cut can be used to good advantage. See Figs. 8 and 9. In drilling this round all the holes, except the lifters and upper cut holes, can be drilled from a crossbar at the top of the tunnel. This gives the holes a good angle in two directions, both toward the center and downward. It is also easy to make a "diamond" cut out of this by drilling two upper cut holes, marked *X*, to meet the two down cuts. However, this would be needed only in extremely hard ground. In fact, this type of round has been used successfully to break very hard rock by drilling the short cut holes marked *Z* in Fig. 8. They can be used to help break a very deep round of holes. Ten-foot rounds have been broken in 8 x 10-ft. tunnels in very hard rock by using these short cut holes *Z* and without the necessity of using the upper cut holes marked *X*.

In Fig. 9, the lower cut holes marked *O* can sometimes be omitted, and the two upper cut holes marked *X* can be drilled to meet the center *O* cuts that end at the middle of the back of the vertical section in Fig. 9. In both of these the order of the shots is shown by the figures at the holes. Thus, *O* indicates no delay or instantaneous electric blasting caps; 1 indicates first delay and so on. Electric firing of the shots insures the proper rotation of the shots, reduces missed shots, and increases the breakage. The 8 x 10-ft. tunnel is an economical section to drive, either for a double-track mine tunnel or an advance heading.

Raises are the hardest places to drill and blast, as all equipment must be carried or hoisted up the raise, and it is hard to get the drills in position to drill a good cut to break well. However, on account of the rock falling out of the face when blasted, there are economies in raising over sinking. As a matter of fact, there is no great difficulty in drilling a large raise so that it will break, but there is in drilling a small one, especially if it is inclined. As a general rule, the *V* cut is used in raises that have one long dimension, and the diamond cut in raises that are square in cross-section, or where the rock is extremely hard.

If the raise follows a vein or seam in the rock, such

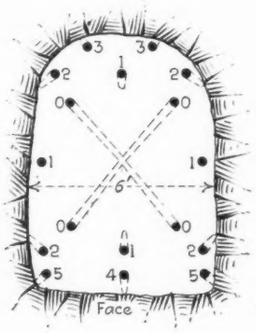
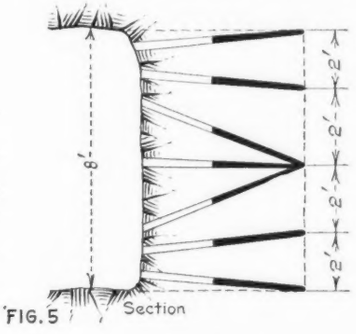


FIG. 5



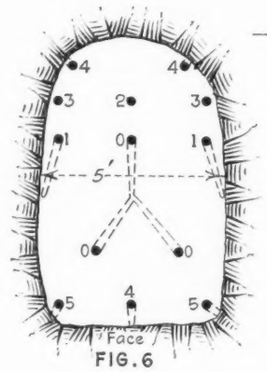


FIG. 6

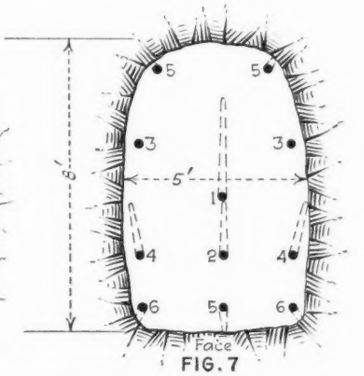
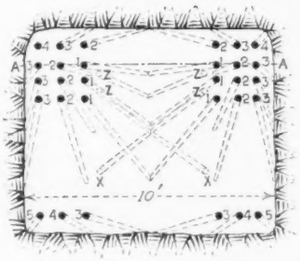


FIG. 7

Alternative rounds for small drifts and crosscuts

Fig. 5 shows a diamond cut for hard ground; Fig. 6 is suitable for medium, and, Fig. 7 for soft ground



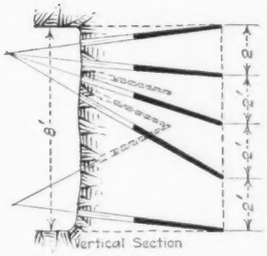
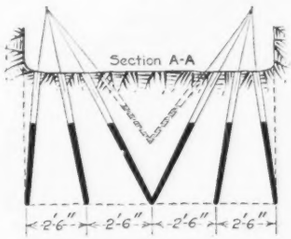


FIG. 8



Drill rounds for larger tunnels

The order of firing, with electric blasting caps, is indicated by the figures. "Z" holes are used in hard rock; "X" holes in extremely hard rock

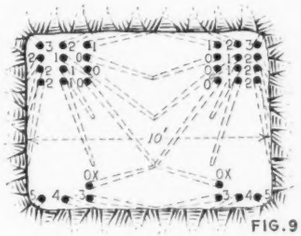
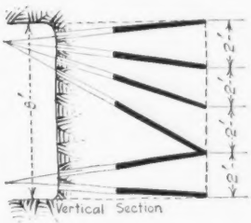


FIG. 9



as the slip between strata, the holes are sometimes drilled toward the slip so as to break to it. Fig. 11, the diamond cut, can be used in sinking a small square shaft also to good advantage. A better angle on the cut holes can be obtained by using jackhammers.

The timbering in a raise often interferes with the drilling of the best kind of a round to break where stoper drills are used. The timber may be too high or too low to act as a support for the telescoping point or to make possible the placing of the drill in the best position for drilling the cut holes. Electric blasting is also advantageous in raises, both because of efficient results, and also from a safety standpoint, because it permits the blaster to get to a safe place before firing the shots.

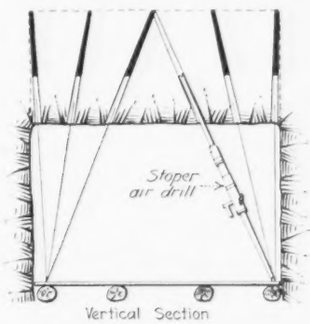
In blasting stopes, the holes are usually drilled according to the size and angle of the stope and the results sought. The spacing of the holes and the explosive to be used depend on the degree of fragmentation desired. Close spacing and higher explosives naturally produce a larger percentage of fines and reduce the subsequent crushing. However, increased fines sometimes involve greater loss in milling, and should be avoided on that account. In other operations, the holes are drilled with a light burden so as to avoid the breaking of large pieces and still not make too large a percentage of fines. This avoids trouble in getting the ore through the chutes and eliminates or reduces the necessary chute blasting, which is, of course, expensive and destructive to the chutes.

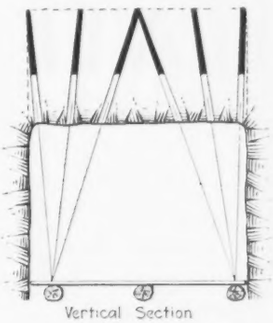
The tendency in stope blasting now seems to be to use the weakest possible powder in long holes and with a light burden on the holes. This breaks the rock to a uniform size, without making an excess of fines. This is especially true in large stopes of hard ore. Miners often drill long, flat holes with 2 to 3 ft. burden on the hole. This smashes the broken ore down on top of the old ore in the shrinkage stope and breaks both a little more on impact. One large company increased fragmentation by drilling stope holes in this way, and then increased it still more by shooting all the stope and block holes in the stope simultaneously by electric blasting. This proved efficient, and prevented covering up large pieces of ore in the stope with the freshly broken ore. In other words, the large pieces were always on top, where they could be easily drilled and block-holed.

The hardest blasting in stopes is in narrow, inclined stopes with hard ore, and especially where the stope must be wider than the vein of ore. In this case, the cut must be drilled as is a raise. See Fig. 12. If the ore is harder than the adjoining rock walls or waste, the rock is usually shot out first and thus the ore is stripped and is shot down later, sometimes on canvas, where it is sorted. If the ore is soft, and adjacent rock must be shot down to make the stope wide enough to work in, the ore is shot out, sometimes on canvas for sorting and sacking (for high-grade ore), and then the rock is shot down later for stope filling.

When large rocks block the chutes it is necessary to blast these rocks either by mud-capping, block-hole blasting, or by placing a cartridge of dynamite on a stick with primer inserted. The fuse is lighted and the stick propped in the desired position. Electric blasting is also safer here, as the blaster can be sure the charge is in the desired position before exploding it. This prevents damage to the chute and is less dangerous to any who might pass.

Correct charging of blast holes depends upon skillfull preparation of the primer and the rest of the charge, as well as properly placing it in the bore hole so as to give the maximum results. One must assume that the proper kind and strength of explosive has been furnished. This is important, because if the explosive is too bulky, or too weak, it will be necessary to fill the hole too full. If the explosive is too strong, or too dense, it will be necessary to use excess weight to fill up the hole far enough, That the explosive placed in the outer third or fourth of a hole does more harm than good is certain. There is a proper height or length of charge for each hole, for efficient blasting. As a





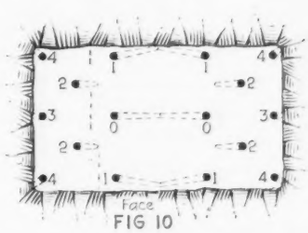


FIG 10

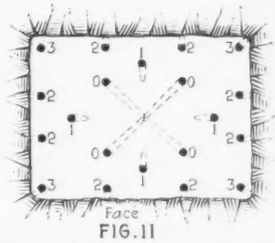


FIG. 11

Drill rounds for raises

The "V" cut, Fig. 10, is usual in raises of rectangular shape, and the diamond cut, Fig. 11, in raises that are nearly square

practical rule, from one-half to two-thirds of the length of the hole should be the maximum length of charge in the average blast hole. The rest should be completely filled with tamping.

Proper Placing of the Primer

Though the general rule should probably be to place the primer last or next to last in the bore hole, there are many exceptions. This loading will point the "business" end of the cap down through the charge, which is also advisable. However, in tunnels, shafts, raises, and, in fact, anywhere that the holes are close together, the primer should be near the bottom of the charge. The main reason is that this is the only position where the fuse is not likely to be cut off by the adjacent charges. Sometimes the cap is pointed back through

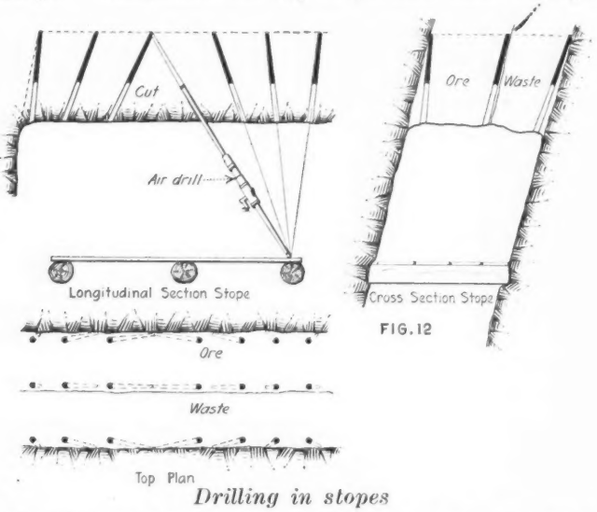


FIG. 12

Drilling in stopes

Fig. 12 shows a stope that is wider than the vein. The ore is hard and a "V" cut, as in a raise, is drilled.

the main part of the charge, but this should not be done where the fuse is cold and the hole is wet. With electric firing, or with a good grade of fuse, in warm work, this will give no trouble.

Each cartridge should have the wrapper slit and be expanded firmly into the hole with a wooden tamping stick. It can be pushed into place firmly, and no hammering is necessary. This eliminates air spaces and increases its effectiveness.

As most explosives can be ignited by the side spit of fuse, care should be taken not to lace the fuse through the dynamite and to see that the fuse is not loaded in direct contact with the dynamite. Burning holes not only fail to break, but also give off dangerous gases. They may also explode after burning awhile.

Though many miners and mining men still argue that the "stemming" of blast holes is not advisable, a preponderance of evidence proves that it is. The U. S. Bureau of Mines tests indicate from 50 per cent to 100 per cent greater efficiency from properly stemmed dynamite, and most practical tests show an increase of at least 20 per cent to 25 per cent. This does not mean that simply stemming a hole will give that increase in results. It means that if proper advantage is taken of the increased force developed by stemming, a 25 per cent saving is possible. Bureau of Mines tests were made in lead blocks and practical tests are made by actually breaking the rock.

It is usually necessary to furnish the miner with tamping bags filled with proper tamping material, so as to get satisfactory results. Then it is as easy to load tamping as more powder. The increased efficiency can be obtained either by better breakage, by using lower-grade powders, or by decreasing the amount of explosive.

On account of the increasing tendency to make high explosives safer to handle, and, therefore, less sensitive to shock, heat, and friction, strong and efficient detonators should be used to explode them. Complete detonation of any high explosive is essential to develop its maximum force. Positive detonation can be obtained only by using high-grade detonators that are in good condition and by making sure that they are completely imbedded in the explosive and securely fastened thereto. They must be protected from moisture, oil, and other foreign matter, both before and after being placed in the charge. That is, water and oil must not be permitted to enter the cap. Electric detonators are, of course, fully protected from this source of trouble.

There are two general methods used in mining for exploding charges of high explosives. Electric firing is one, and the fuse and cap is the other.

In the use of fuse and cap it is important that a reliable fuse be used, and that it is suitable to the conditions. Water-proof fuse should be used in wet work, and it should be carefully warmed before being used, if it is cold.

The cap should be securely fastened to the freshly cut square end of the fuse by being tightly crimped with a good crimper with a wide jaw. A knife-edge crimper is likely to cut off the powder train.

Fuse is more or less affected in burning speed by slight differences in pressure. For instance, fuse that burns at the rate of thirty seconds per foot at sea level will burn at the rate of forty seconds per foot at 5,000 ft. elevation, and fifty seconds per foot at 10,000 ft. elevation. Thus, the compression of a fuse in use should be fairly uniform. Fuse in a hole full of water will burn faster than fuse in a dry hole, although it does not get wet. That explains why a wet lifter often explodes before a dry back hole, even though the fuse is a little longer.

Sequence of Firing Important

In shooting holes in sequence, which is necessary in drift and tunnel rounds, it is imperative that the difference in lengths of the fuse be sufficient to insure correct order. Most fuse is uniform, but when miners shoot a round of twelve or fifteen holes, and allow a difference of only one inch between fuses in adjacent holes, it is easy to understand why the order of the holes may not be correct. At least two inches difference is the minimum: the shortest fuse in a twelve-hole round is twenty-four inches shorter than in the lifters.

Electric firing is coming into more general use. It is more positive, less affected by moisture, and much safer to use than fuse and caps. Holes can be fired either simultaneously or in any desired order by one operation of the blasting machine, or one throw of a switch. Delay electric firing equipment can be obtained in five periods with delay electric blasting caps, making six periods with the instantaneous. These are thoroughly water-proof and substantial, and are especially valuable for wet work. Delay electric igniters can be obtained in any number of delays, either with or without caps attached. As many as twenty delayed shots can be obtained by using these.

Electric firing has been made practical by the use of a blasting galvanometer. This is a sturdy yet sensitive little pocket instrument, that uses so delicate a current that one can measure the resistance of one electric igniter or exploder without danger of premature ignition. It measures the resistance of a blasting circuit directly in ohms with reasonable accuracy. This device will detect breaks and shorts and eliminates the uncertainties of electrical blasting.

Switches for using current from regular power lines can be made and installed in a lock box in such a way that the box cannot be closed or locked unless the switch is open. This is a safeguard. Blasting machines with a capacity as high as 200 holes can be obtained, and they are substantial and reliable.

Nothing but practical and proved practice has been described in this article. All practices recommended are in actual and successful operation. Care has been taken to avoid experimental or theoretical ideas except such as have been proved practicable.

Theoretical formulas for calculating charges of explosives are interesting from a scientific standpoint, but none have yet proved practical to my knowledge.

General information, knowledge, and judgment on the practical application of explosives are undoubtedly valuable, and especially so in starting new operations. Still, it is always advisable to work out, to some detail, the efficient use of explosives in each operation, as conditions are seldom the same at any two properties, even when they are close together. This can be done only by a detailed study of conditions, requirements, rock formations and characteristics, and all other factors affecting the use of explosives and the results to be obtained.

Marketing Aluminum

How the Newest of the Major Metals Is Bought and Sold

By A. H. Hubbell
Managing Editor

OF THE MAJOR METALS, aluminum, the lightest, is the latest to come into general use. When its manufacture in the United States began—about thirty-five years ago—it was a novelty. Today its uses are many, and new ones are constantly being devised. Production has increased from a modest 60,000 lb. or so in 1890 to an amount that is now probably around 200,000,000 lb.

Aluminum is sold as sheets, ingots, castings, powder, and various alloys, and in a large number of manufactured forms. The total tonnage of sheets used for various purposes is larger than that of any other form in which the metal comes. Ingot aluminum is to be had in the following grades: 99 per cent (aluminum), 98 to 99 per cent grade, and "No. 12" alloy, containing 92 per cent virgin aluminum and 8 per cent copper. A large quantity of remelt or secondary aluminum is also handled. Ingots are customarily in the form of notched bars of 3 lb. weight. A larger ingot weighing 30 lb. is also made by at least one of the producers. In addition to the regular No. 12 alloy, the principal producer supplies a considerable tonnage of "hardeners," which are made of aluminum and copper, or aluminum and silicon, in proportions suitable for the foundries to mix in with their metal to secure any desired composition. These hardeners are generally made in the shape of waffle plates of various sizes and about an inch thick, to facilitate breaking them up.

The automotive industry is the largest consumer of aluminum. The metal is also used in important quantities in airplane manufacture—for framework and engines; in making light alloys, of which duralumin is the best known. This alloy contains from 93 to 94.5 per cent aluminum, about 0.5 per cent (almost always) magnesium, 4 per cent copper, and an additional 0.5 of manganese. In some compositions of alloys of this group there is a tendency to substitute iron for manganese, but such alloys are not strictly duralumin, although coming under the same patents. The principal producer of aluminum markets its form of duralumin under the name of 17-S alloy.

Aluminum is also used for overhead electrical transmission in the form of bare cables; also as busbars, and in the field coils of heavy traction motors. It has been used for insulated work only to a limited extent. One pound of aluminum will do the work of 2 lb. of copper, so there is a saving in the cost of the metal alone at any price under double that of copper. Even with the price of aluminum more than double that of copper, as at present, there is today an extensive use of the former metal for high-tension power lines, because of the contingent economy that can thereby be effected in tower construction: that is to say, since the aluminum, when reinforced, can be strung up more tightly, the towers can be spaced further apart. Thus there is a saving in steel and insulators required and in construction cost. The amount of aluminum used annually for overhead wire and cable in the United States is estimated at about 25,000,000 lb.

Various manufacturing industries—those making sugar, soap, varnish, and preparing foodstuffs, and others—use large vessels, tanks and receptacles of aluminum. It is used for cooking utensils, die castings, bearings and other machine parts; in the form of foil for various purposes as a substitute for tin; in the form of powder, for painting, lithographing, gold precipitation, and thermit welding, and for making ammonal, an explosive. At least 20,000,000 lb. is used annually as a deoxidizer in making steel. It is used for numerous other purposes also.

The subject of how aluminum is marketed can be treated very briefly. There is only one producer of virgin aluminum in the United States, the Aluminum Company of America, with headquarters in Pittsburgh. It is by far the most important factor in the industry in the country. It owns its own mines and its power plants, and manufactures a large part of the metal it produces into a wide variety of products. Its foreign subsidiaries are The Northern Aluminum Co., Ltd., Toronto, Canada; The Aluminum Company of South America, with offices in Argentina, Chile, Spain and Brazil; The Northern Aluminum Co., Ltd., London and Bombay; L'Aluminum d'Amerique, London; and The Asia Aluminum Co., Tokyo, Japan. The parent

company has offices in most of the large cities of the United States, through which it disposes of its products.

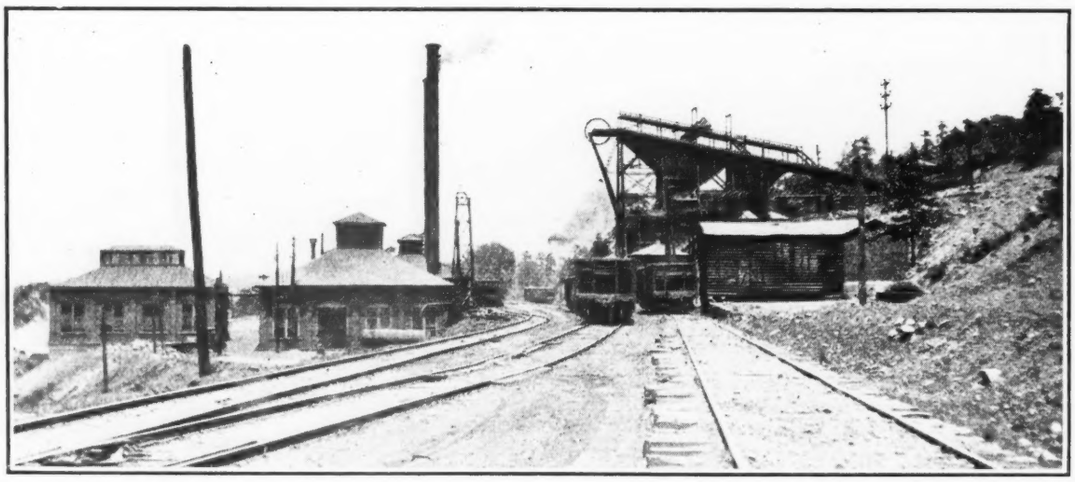
The present widely ramified organization of the Aluminum Company has been built up by the expansion of its own business and operations, and is not the result of the acquisition or combination of independent plants, with one or two exceptions. Thus it is not a trust, in the usual understanding of that term. However, it is readily seen that it dominates the industry, and that prices and trade practices are largely whatever it chooses to make them. Despite the fact that its production is greater than that of any foreign producer, that it has a monopoly of production in the United States, and that it mines its own ore and has its own power plants, it nevertheless enjoys a tariff of 9c. per pound on aluminum in coils, plates, sheets, bars, rods, circles, disks, blanks, etc. (to quote the schedule), and 5c. per pound on aluminum, aluminum scrap, and alloys of which aluminum is the component of chief value.

Imported aluminum at present comes from three sources—the British, French and Swiss producers, whose agents in the United States are, respectively, Arthur Seligman, New York, representing the British Aluminum Co., Inc.; the International Ores & Metals Selling Corporation of New York, representing L'Aluminium Français; and J. E. Dockendorf & Co., Inc., New York, representing the Société Anonyme pour L'Industrie de L'Aluminium, of Neuhausen, Switzerland. German aluminum is said to be practically nonexistent in the domestic market at the present time. It was, however, a disturbing factor during 1920 and 1921, owing to the low prices at which the producers in Germany were able to offer in New York. It is quite probable that the future will again see important quantities of ingot and fabricated aluminum arriving here from German works. C. Hollesen & Co., of New York, are the representatives in the United States for the German producers. Demand for aluminum abroad has been so keen that at times very little foreign metal has been offered and the price quoted is occasionally higher than that asked by the Aluminum Company of America. The important European producers cultivate their home markets first. In point of size they are comparable with the American company.

Consumers customarily buy to cover their needs for three months, six months, or a year ahead, though latterly it has often been difficult to buy for a longer period than a half year. Lots may be a half million pounds or more. Purchases are made under contract, the form of which varies little. This contract specifies description, quantity, price, terms, and delivery. Terms are arranged to suit the contracting parties. Delivery of a definite quantity per month is usually required on the long-term contracts. When imported aluminum is purchased, the monthly deliveries are generally made from the importer's warehouse in the United States. Spot aluminum is usually obtainable in small lots, except in times of shortage of the metal.

The price specified in the contract is that prevailing on the day of sale. There is no future market, such as exists in the copper industry. Quotations on foreign aluminum, under the circumstances, are based on the price asked by the American producer, as would naturally be the case in view of the advantage given the latter by the tariff. At present (Nov. 25) 99 per cent aluminum is quoted at 28c. per lb. and 98 to 99 per cent, 27c. per lb., which is about a cent higher than on Jan. 1 last and about 5c. more than the price of Jan. 1, 1923. Most aluminum is sold under long-term contracts. The price on small lots that change hands in the open market is likely to vary considerably from the contract price.

The supply of aluminum is rarely more than enough to meet visible needs. This condition of the market is at times ascribed to the control of production, but, on the other hand, the opinion has been expressed that with every plant in the world running at normal capacity there never would be a surplus of aluminum; that the great investment in power plants necessary for the production of aluminum is not comparable with that of any other metal, so that the producer must make and sell all the aluminum he can, in order to liquidate, as far as possible, the immense overhead charges on his power plants. In the absence of reliable data as to the production and sales of the metal, it is interesting to consider the statement of one company to the effect that a survey would show most plants in the United States and elsewhere to be continually producing.



Tipple, hoist, and compressor house, Republic Iron & Steel Co.'s Raimund No. 1 ore mine, in the Birmingham district, Alabama

Blast Roasting an Improvement Over Old Patera Process in Bolivia

Cyanide Process Not Adaptable to Local Conditions. Holt-Dern Roasters Have Been Installed at Two Plants

By Robert D. Ferron
Metallurgical Superintendent, Cia. Huanchaca de Bolivia, Pulacayo, Bolivia

UNTIL THE MIDDLE of the nineteenth century, silver was recovered from its ores by either smelting or amalgamation. Complex, refractory ores were often roasted with salt before treatment by amalgamation, to convert the silver to the chloride form, as silver chloride is readily amalgamated with mercury.

About 1840, the Augustin process was introduced. This consisted of the chloridizing roast as before, but followed by a leach with concentrated brine and precipitation of the extracted silver on metallic copper. The process was used largely for the treatment of silver-bearing copper matte, and proved poorly adapted to the treatment of ores, because of the low solubility of silver chloride in brine solutions. A similar treatment, the Longmaid-Henderson, was developed for the extraction of copper from roasted pyrite. In this latter, the solutions were made acid by washing roaster gases, and leach liquors were precipitated on scrap iron.

About twenty years later, the Patera and Kiss processes were applied. Again the ore was given a chloridizing roast, but the silver was leached out with solutions of sodium or calcium hyposulphite, and precipitated by sodium or calcium polysulphides. This method soon proved superior to amalgamation. Introduced originally in Europe, its use soon spread to North and South America. Practice in the United States and Mexico at this time has been well described by O. Hofmann and C. A. Stetefeldt.

When the cyanide process was introduced, and smelters became more easily available, most of the old plants employing the hyposulphite leach were shut down. Only in a few localities, among them Bolivia, has a combination of peculiar conditions caused the persistence of the Patera process to the present day.

Reasons for Present Bolivian Practice

The lack of local lead or copper smelters, and the high freight charges to the outside, prohibit the shipment of any but high-grade ores or products. Cheap salt, in unlimited amount, is available from the various closed basins of western Bolivia. Numerous semi-active volcanoes supply sulphur. Lime is also locally obtainable. Hence the Patera process, producing high-grade silver sulphides, has continued to prove an economical treatment for many high sulphur ores that require little fuel to roast. Most Bolivian plants show no improvement over those described by Hofmann thirty years ago. The roasting, which constitutes the basis of the process, is still largely performed in hand-rabbled reverberatory furnaces.

Bolivian ores treated by the chloridizing roast may be divided into two general classes: (1) Pyritic silver-tin ores, and (2) complex ores whose chief value lies in contained silver, and which are usually high in sulphur.

In the treatment of silver-tin ores, a double object is sought: the concentration of the silver and tin separately in high-grade shipping products. The ore is usually given a chloridizing roast, leached with hypo or brine to remove the silver, and the tin concentrated from the tailing. Probably the most interesting work toward modernizing the apparatus employed has been done at Machacamarca, and has been described by M. G. F. Sohnlein (*Bulletin* A. I. M. E., August, 1920). Most of the experimentation was with the roasting furnaces. Attempts to substitute mechanical, multiple-hearth naces for the old, hand-rabbled reverberatories were not successful. A modified Merton furnace, with mechanical rabbling and a slight drop between the three hearths, did better work and was adopted for the plant. The chief advantages of this furnace were a marked reduction of the silver loss by volatilization during the roast, and a high chloridization of the silver. The furnaces were operated intermittently. The operation of the modified furnace paralleled closely that of the hand-rabbled reverberatories; the mechanical rabbling showing a saving in labor and resulting in more uniform chloridization.

Ores falling under class 2 usually contain silver associated with some combination of blende, pyrite, galena, tetrahedrite, various complex antimony or arsenic sulphides, and other materials. They are usually not amenable to lixiviation with cyanide, either raw or after an oxidizing roast. Most of these ores cannot be concentrated to silver shipping products sufficiently rich to compete economically with the sulphides produced by the Patera process. An example of the application of the Patera process to a complex ore is given below.

The ore treated assays about as follows:

	Per Short Ton		Per Short Ton
Silver, oz.	40	Iron, per cent.	23
Lead, per cent.	2	Copper, per cent.	1
Zinc, per cent.	12	Sulphur, per cent.	24

The ore is ground to minus 30 mesh in ball mills; roasted in small, three-hearth reverberatory furnaces with 6 per cent of salt; leached with water followed by 0.3 per cent hyposulphite solution; the water passed over scrap iron, and the hypo solution precipitated by adding lime and soda polysulphides. Treating about fifty tons per day, the plant makes an actual recovery of 70 to 75 per cent of the silver, in the form of a sulphide assaying 45 per cent silver. Total plant costs are about $7 per ton treated. The biggest item is labor on the hand-rabbled reverberatories. The plant is old and poorly designed, so that somewhat lower costs could probably be secured in a new plant, employing the same general scheme of treatment. Metallurgical results may be summarized as in the table below:

Per Cent	Gold	Silver	Lead	Copper
Furnace volatilization loss	20	9	18	16
Loss in tailing	35	15	77	64
Recovered	40	70	1	15
Unaccounted for	5	6	4	5

Holt-Dern Blast Roast Process

Present chloridizing blast roast practice had its beginning in experimental work started in 1911 at the University of Utah by Theodore P. Holt and N. C. Christensen. About two years later, the Salt Lake station of the U. S. Bureau of Mines continued the work in conjunction with the University of Utah. In Utah, as in Bolivia, salt is cheap and plentiful. The result of this work was the development of a process

employing a blast roast for the chloridizing, and an acid-brine leach to remove silver and copper. The use of the blast for the chloridizing roast constituted a new idea in silver metallurgy, and allowed many economies over the old practice. The new process was first commercially applied by the Mines Operating Company at Park City, Utah, for the treatment of old stope fillings. Operations here have been well described by Glen A. Keep. (*E. and M. J.*, Feb. 6 and 13, 1915.) Many new developments were worked out here, of which the most important was the Holt-Dern continuous roaster. The process proved a decided success. Among its advantages over the older Patera procedure are the following:

1. Good chloridization secured on much coarser ore.
2. Silver volatilization loss reduced to a negligible quantity.
3. Little or no fuel employed for roasting.
4. A decided saving in labor required.

The new process, by increasing the recovery of silver, and especially by reducing operating costs generally, proved far superior to previous chloridizing practice.

Two mills employing the blast-roast treatment were subsequently erected in the Tintic district, Utah. That of the Tintic Milling Co. operated for some years as a custom plant, in competition with the Salt Lake Valley smelters. The other mill was erected by the Tintic Standard Co. to treat low-grade ores from the company mines and has given satisfactory results. Articles by N. C. Christensen, Theodore P. Holt and others have described some of these installations and the results secured.

The advantages of the chloridizing roast on complex ores under Bolivian conditions have already been discussed. The high costs of treatment and low recoveries resulting from the old Patera process have limited the treatment to relatively high-grade ores. Hence, many low-grade complex ore dumps exist. In working out a feasible plan of treatment for certain of these dumps and for low-grade mine ores, the blast roast process was tried in 1919 by V. J. Hampton and myself. It proved successful, and has now been introduced in Bolivia. A 50-ton per day plant has been installed by Theodore P. Holt and is now in successful operation on the property of the Cia. Beneficiadora de San Vicente, at San Vicente, Bolivia. A single-unit pilot plant has given good results at the Pulacayo mine of the Cia. Huanchaca de Bolivia. The experimental work here has hinged largely upon adapting the blast-roast process to a high-sulphur ore. The problem has been successfully solved by reducing the sulphide sulphur content of the furnace charge by returning a portion of the calcine to the charge bin to be mixed with the crude ore.

Widespread interest is being shown in the blast-roast process by many mining companies in Bolivia, and it seems probable that another step forward in local silver metallurgy has been made.

Past and Present of American Potash

WITHOUT RENEWAL of potash, nitrogen, and phosphorus in the soil, profitable raising of crops from which food and clothing come cannot be continued indefinitely. These are the three important ingredients of artificial fertilizers. Potash is used also for many industrial and domestic purposes. In 1923, the United States consumed 783,689 short tons of crude potash salts, for which the users paid $16,189,243, all but 4 per cent imported from Germany and France.

Early in the history of this country, according to a paper prepared by the Engineering Foundation, potash was obtained by leaching wood ashes. Potash mineral deposits were discovered in Germany in 1857, in Alsace in 1904, and in Spain in 1912.

For the first fifteen years of the twentieth century the American industry practically was extinct, the supply coming from Germany. In 1910, the German Government virtually created a government potash monopoly with control over both production and prices. This act was accompanied by a sharp advance in price to American consumers, despite contracts then existing and antedating this act. This situation led to determined efforts by the United States Government to find cheap domestic sources of potash, and in 1911 Congress provided for investigations by both the Geological Survey and the Bureau of Soils.

The war threw the United States upon its own resources for potash as for many other chemicals previously obtained from Europe. Geologists and chemists sought potash from all possible sources, with some success. In 1918, the banner year, 128 plants produced 55,000 tons, mostly from Nebraska salt lakes and as a byproduct from the manufacture of sugar, salt, cement, and steel. Small quantities were obtained from kelp, wool washings, wood ashes, and distillery wastes, from the minerals alunite, leucite, glauconite, and from silicate rocks. In 1922 there were twelve plants. In September of that year, potash went on to the tariff free list. Again the industry almost vanished, but the situation is different from that before the war. Persons interested are now informed of great resources in this country, and a potash plant that gives promise of permanent production has been in operation at Searles Lake, California, since April, 1922. An important geological discovery has also been made supplementing the ingenious processes devised by chemists for obtaining potash as a byproduct.

In 1912, Prof. J. A. Udden, of the University of Texas, found traces of potash in brine from a well drilled for oil at Spur, in Dickens County. In 1914, he found small fragments of crystals of a red potash-bearing salt at a depth of 875 to 925 ft. in a well at Boden, Potter County. Subsequently such fragments were found in many wells drilled for oil. Although drillers for oil have little interest in anything else and their records consequently are unsatisfactory to geologists exploring for other minerals, nevertheless the existence of extensive beds of potash mineral at accessible depth and of profitable richness appears to have been established. Extensive skillfully directed drilling remains to be done to locate the best deposits and to determine their area in thicknesses.

Polyhalite is the mineralogical name of the potash-bearing mineral discovered in the oil wells of western Texas and eastern New Mexico. It contains, when pure, 15.6 per cent of potassium oxide. In color it ranges from dark brick red to light red and salmon, or it may be colorless. It is composed of the sulphates of magnesium, potassium and calcium and is a low-grade ore of potash. It is soluble, and, as all sulphates are beneficial to most soils, the rock as mined would be a water-soluble fertilizer containing at a maximum the equivalent of 15.6 per cent potash.

The "Groma" or Cross Bar of the Roman Surveyor

By Don Gelasio Caetani
Italian Ambassador to the United States

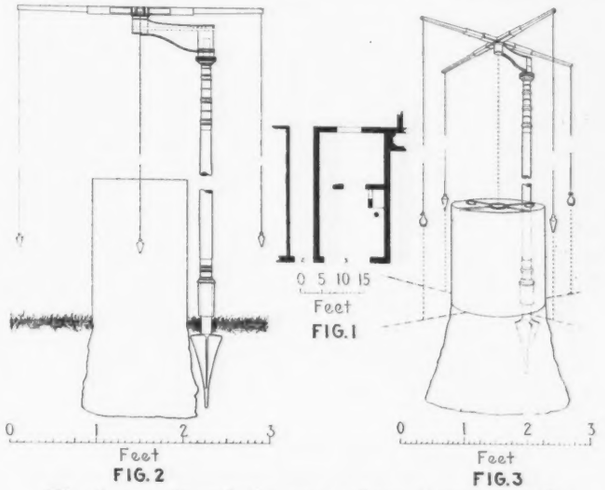
Don Gelasio Caetani

MOST PEOPLE are greatly astonished when told that the old Romans wore hats and pants, that they used wire ropes, that the water supply in their homes was regulated by bronze plug valves similar to those that you buy today in a hardware store, and that for heating water quickly they had tubular boilers and so forth. One does not really know why the belief should prevail that the Romans, who equaled or surpassed us in artistic and intellectual achievements, should have been technically primitive just because they lived nineteen centuries ago.

Independently of the foregoing remark, considerable interest was aroused a short time ago when a "groma," or crossbar for rough surveying, was discovered in Pompeii on the floor of a workshop on Abundance St. that collapsed under the weight of the lapilli in the year 79 of our Lord, during the great eruption of Vesuvius.

Not many years ago excavations at Pompeii were being carried out in the ordinary way: to free the ruins, the cinders and lapilli were expeditiously shoveled into wheelbarrows and dumped out without being closely examined, and only the large and well-preserved objects of marble or bronze were recovered and placed in the museum. The technique has now completely changed: the dirt is slowly removed layer by layer and carefully sifted so that not even the smallest relic of the past may escape careful scrutiny. When an object, as, for instance, a door, has faded into nothing because made of perishable material, whenever possible a plaster cast is taken of the mold it has left impressed in the consolidated volcanic ash. Then, with infinite patience and accuracy every object is brought back into the position it occupied before the catastrophe, reversing, so to say, the very movement the object had followed eighteen centuries ago, when it collapsed under the weight of the eruptive material; bricks and stones are piled back into position; the fragments of artistic stucco work are recomposed like a Chinese puzzle and fastened into their original position against a reinforced concrete ceiling; the tiles that had fallen on the top of the crumbled building are returned to cover the new rafters of the roof. It is just like taking a cinema film of a house that collapsed and then running it backward on the screen.

A short time ago, while examining the floor of the workshop that had belonged to the mechanic and coppersmith Verus, in the place indicated by an asterisk in Fig. 1, there were found a number of little bronze and iron relics that greatly puzzled the director of the work, Prof. Matteo della Corte. After a long and careful study, he succeeded in understanding the true nature of the original object, which turned out to be a "groma," or crossbar, of the Roman conveyor. The instrument reconstructed in its original form is shown in Fig. 2, drawn from Prof. della Corte's monograph published in the *Transactions* of the Accademia dei



The "groma" and the spot where it was found

Fig. 1—Floor plan of workshop of Verus at Pompeii. Fig. 2—Sketch of the instrument drawn from Prof. Matteo della Corte's monograph. Fig. 3—Another view of the "groma" on a scale different from that in Fig. 2.

Lincei. The "groma" is a simple instrument that does not need to be explained to the readers of the *Journal-Press*, but it may give them an idea how to improvise a rough surveying instrument if by chance they should want to lay out the corners of a mining claim when unexpectedly running across a valuable mineral outcrop—an experience that has not yet befallen me.

The Electrometallurgy of Beryllium

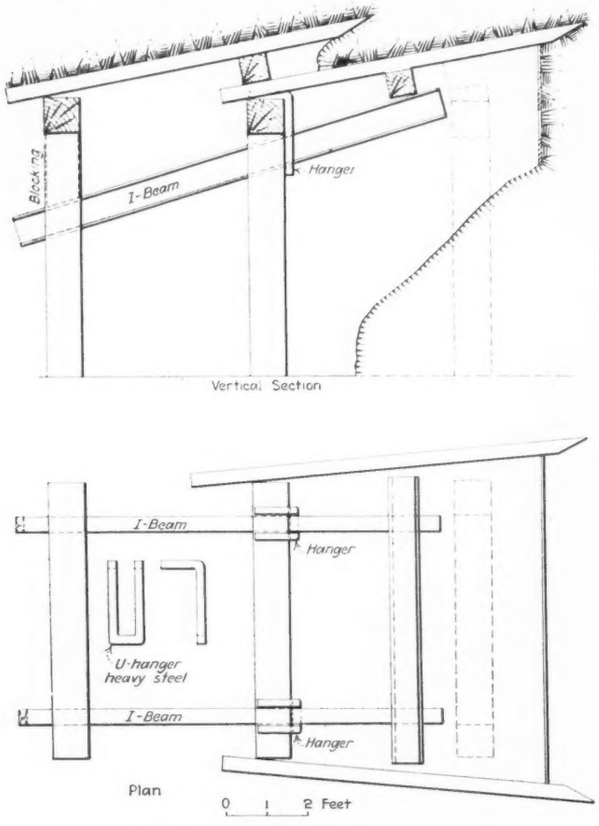
A critical study of the electrometallurgy of beryllium, as reported in a paper by E. A. Engle and B. S. Hopkins for the American Electro-Chemical Society, establishes the fact that beryllium oxide is soluble in various fused salts, from which solutions metallic beryllium may be deposited electrolytically. More efficient results are secured by the electrolysis of a fused bath of barium fluoride and sodium beryllium fluoride. These electrolytes combined such desired properties as density, relative inertness and suitable melting temperature. The use of a molten metal cathode yields directly the corresponding beryllium alloy in many cases.

In work on the electrolytic production of beryllium, reported in another paper by B. S. Hopkins and A. W. Meyer, residues from Texas gadolinite were treated with hydrochloric acid and sodium bicarbonate to separate iron and aluminum from beryllium. Beryllium basic carbonate was prepared, from which a double fluoride, essentially $NaBeF_3$, was obtained. This salt was fused and electrolyzed, using a carbon anode, a nickel crucible as cathode, and a current of 6 amperes at 110 volts. Metallic beryllium was obtained as thin flakes scattered through the electrolyte, and mixed with beryllium oxide and carbide. The metal was separated from everything except the oxide by sprinkling into water; the oxide was removed by centrifugal force. Metal of 98 per cent purity was obtained, but the yields were poor.

Useful Operating Ideas

Forepoling Method Used at Shattuck Mine

The lower part of the orebody in the Shattuck mine, operated by the Shattuck Arizona Copper Co., Bisbee, Ariz., was first encountered on the 800 level and later followed to within 40 ft. of the surface. The lower levels were worked out first, and most of the ore in recent years has come from the 300 level and is mined by the caving system. As the lower part of the orebody was mined first, the unmined part has settled and



Forepoling method in loose ground

cracks have extended through to the surface. In addition, natural cavities occur in the ground. This condition makes it difficult to hold the ground and to advance development drifts through the ore. Forepoling is necessary, therefore, in all drifts in this area, and to facilitate the work and to increase the safety of the men, J. Walker, mine superintendent, devised the method of spiling shown in the accompanying figure.

After the top spiling has been driven in the usual way, two six-inch I-beams are hooked to the last cap in place by means of heavy steel hangers, and the ends are extended forward to just back of where the cap of the next set will be when in position. A crosspiece is then placed across the forward ends of the I-beams and brought up snugly against the spiling by blocking down the back end of the I-beams under the second cap back. The timber set can then be put in without danger from the top. Side spiling and breast boards are placed in the usual manner.

This method of forepoling is also efficacious in advancing a working through a cavity where there is danger of falling rock. If there is no rock to support the top spiling, the I-beams and boom are placed first and the spiling is placed on top of the timber. In advancing through open cavities it is necessary to block the back ends of the I-beams to prevent side sway in case of a fall on the spiling.

This method[1] has been in use at the Shattuck mine for a number of years. Other mines are also using the plan for catching up open ground.

Leyner Drill in Underground Prospecting

By Roy H. Poston

The use of diamond drills for prospecting underground involves high costs where short holes and frequent set-ups are necessary. This condition at St. Francois, Mo., has resulted in the development of a home-made rig for drilling holes less than 100 ft. in depth. For this purpose a Leyner drill, No. 8, model 6, was changed by removing the valve chest cap next the crank end of the machine and boring and threading it for attachment to the body of an air valve. (See detail *A*). This is used to blow air through the drill to clean out the cuttings in the hole, at the driller's option.

The completed valve is replaced in its original place in the drill. In operation, the valve plunger is pressed down as far as it will go, holding the air-valve mechanism of the drill in such a position as to allow the air to be diverted directly into the water tube and thence through the drill. The usual air pressure in the mine is used for drilling. The drill steel is cut into 3- and 6-ft. sections and threaded on the ends to fit a small coupling made for this purpose.

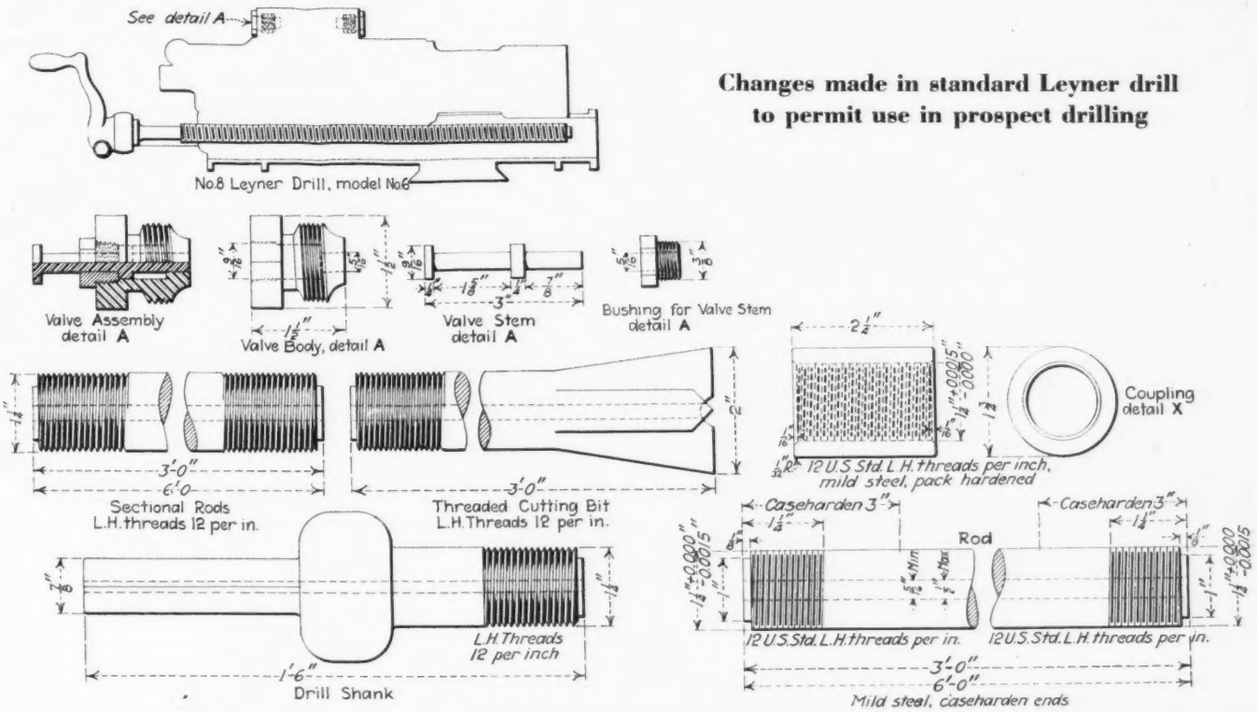
The threads are left hand, twelve per inch. Care is taken to see that when the joints are assembled the two ends of the connecting steels butt together; otherwise the impact of the drill will ruin the threads in a few seconds.

In addition to the sectional steels threaded on both ends, the shank end of several other drills is cut to about 18-in. lengths and threaded to receive the coupling. Bit ends, cut to 36-in. lengths and with cutting ends two inches in diameter, are also threaded. Details are shown in the drawing. A standard 3-ft. drill with the bit enlarged to two inches is used as a starter for the drill hole.

In operation, the drill is mounted on a standard col-

[1]The method described in the foregoing article was first suggested by G. J. Young, associate editor of the *Engineering and Mining Journal-Press*, in an article in the *Engineering and Mining Journal*, Jan. 21, 1911.—EDITOR.

umn or tripod in the usual manner, and the 36-in. starter is inserted in the drill chuck. After drilling the full length, the machine is cranked back, the starter removed, and another drill, consisting of an 18-in. shank and a 36-in. bit, assembled with a coupling, is substituted and the drilling continued. Another section is added as the hole is deepened. A 72-in. section


See detail A
No.8 Leyner Drill, model No6
Valve Assembly detail A
Valve Body, detail A
Valve Stem detail A
Bushing for Valve Stem detail A
Coupling detail X
12 U.S Std. L.H. threads per inch, mild steel, pack hardened
Sectional Rods L.H. threads 12 per in.
Threaded Cutting Bit L.H. Threads 12 per in.
Case harden 3"
Rod
12 U.S. Std. L.H. threads per in.
L.H. Threads 12 per inch
Drill Shank
Mild steel, case harden ends

Changes made in standard Leyner drill to permit use in prospect drilling

is substituted for the 36-in. section and these two are alternated for the entire length of the hole, the 36-in. section being always the top section next to the drill. The original bit must be retained for the entire length of the hole, as the bit loses gage with use, and a new bit would not follow. The usual water connection is employed to wash out the cuttings, but this is supplemented occasionally by the manipulation of the home-made air valve described in a foregoing paragraph.

About seventy-five holes have been drilled to date, totaling 2,750 ft., or an average depth of 35 ft. The deepest hole was 78 ft. and inclined 5 deg. up. Most of the holes were 30 deg. up or 35 deg. down. A few were horizontal. One operator has done all the drilling, working an eight-hour shift, the average footage per shift being 35 ft., with an occasional 50-ft. hole. If the hole pitches up or down to any extent, say 20 deg. or more, one man can handle the rods to a depth of only about 65 or 70 ft. The rods weigh approximately four pounds per foot, excluding couplings. The ideal hole is one that pitches a few degrees up, as this requires the least effort to handle the rods and allows the cuttings to be easily cleaned out without excess air or water.

The operator has no water-pressure gage on the line, but is of the opinion that the water pressure has not exceeded 10 or 15 lb. Experience indicates that the use of as little water as possible is desirable just before drawing out of the hole to change drills, as excess water tends to settle all the fine rock and sludge on the bottom and makes it difficult to get back on bottom. The labor cost is approximately 16c. per foot, the driller being paid on a footage basis. Accurate equipment costs per foot cannot be given until more drilling has been done.

It is believed that the use of three-foot rods instead of six-foot rods in deep down holes would prove advantageous, because the time required to crank back a six-foot rod to permit the insertion of a new section allows a great deal of sludge to flow down and settle on the bottom of the hole, thus making it difficult to get the bit back on the bottom of the hole. Some trouble is experienced with rock cuttings that are not sufficiently broken to pass the coupling on the rods and therefore do not get out of the hole while drilling. To remedy this condition it is proposed that a rose bit with eight cutting edges be used, instead of the present cross-bit, and also to bevel square shoulders of the rod couplings. The couplings are made of cold-rolled steel and are a little too soft to stand the continued strain, but it is believed that casehardening would remedy this defect.

The chief disadvantage of this type of drill is the inability of obtaining a core of rock from the hole. A core barrel was made from a section of diamond-drill core barrel and threaded to fit the sectional drill rods. A cutting bit was also made from an unused diamond-drill bit, without the diamonds. It was provided with cutting edges and tempered. This arrangement proved satisfactory in that cores, or rather a series of rock bottoms, were obtained from the hole, but its use was discontinued because of the loss of speed in drilling and the time consumed in pulling out and replacing the rods in the hole to empty the core barrel.

A reliable driller's record is considered sufficient evidence of ore-bearing ground. Occasionally a drill breaks while drilling and leaves a piece in the hole. This is usually recovered without difficulty unless there is too much débris in the bottom of the hole. Under such circumstances, it may be necessary to abandon the hole.

Discussion

Mine Cost Accounting

Irving H. Wentworth

THE EDITOR:

Sir—The writer has taken it upon himself to make a few remarks on this subject in the way of discussing the article "Factors in Mine Cost Accounting," appearing in the *Journal-Press*, issue of Sept. 20, 1924. The general impression the author of that article has created in my mind is that he is laboring under a hazy idea as to just what is essential regarding costs, and how they should be compiled. Then, again, his conception of the meaning of some of the accounting terms is erroneous, which results in confusing him the more.

I believe it worth while to point out a number of these misused terms here, as I have discovered that a great many persons use them incorrectly, even bookkeepers and other office men, who one might suppose are perfectly familiar with their meanings. Perhaps the most misused one of all is the term "reserve fund." The author has used it at the top of page 463, second column, when he undoubtedly meant a "deferred charge." A reserve fund is an amount of money that is being accumulated to be spent at some future time in some specific undertaking—for example, the accumulation by setting aside a certain sum each year for a certain number of years with the object in view of retiring a bond issue when it becomes due; or for the enlargement of a plant. A deferred charge is where a certain amount of expense has been incurred, but from the nature of the conditions it would not be appropriate to charge it all off during that period, but it should be spread over a number of succeeding periods. The author's terms "Maintenance Reserve" and "Development Reserve," found in the same place, also refer to deferred charges for maintenance and development, for, as I have just stated, the word "reserve" would infer that funds were being set aside to be used in maintenance and development at some future time. The term "reserve" is also used in another sense in accounting when referring to a reserve for depreciation. Here it does not represent an asset. On the contrary, it designates an amount by which a capital asset, such as buildings, equipment, or similar asset, has become depleted in value through the effects of time and use.

At the bottom of page 466, second column, and the top of page 467, first column, appear some more terms I wish to criticize. "Amortization of capital" probably means a deferred charge, such as for development work done at some previous period. Dividends have been mentioned in connection with expense. Now a dividend is not an expense. It is simply a portion of the unappropriated and accumulated profits (surplus) of a corporation, which the directors distribute among the stockholders in proportion to each individual's holding. The term "surplus for plant expansion" means reserve for plant expansion, and, of course, would be included in the Surplus Account. It is entirely wrong, though, to consider it as an expense.

I want it to be understood that my criticisms here are only of the most friendly, and that the author is to be commended for speaking out, inviting discussion, to clear up his doubts.

Of course, to discuss a topic like this intelligently, a knowledge of accounting is essential; and speaking from personal experience I heartily recommend the study to all those whose aim is for better and more efficient management.

INSTALLING AN ACCOUNTING SYSTEM

Without going into the subject too deeply, but at the same time endeavoring to offer a solution to some of the problems presented, let us suppose that a company has been duly organized and financed to develop and operate a mining property.

At the very beginning, a code of accounts should be carefully drawn up by an expert accountant, which will govern the accounting methods. This code describes the accounts, and prescribes how they are to be used. These rules should be strictly observed.

To draw up a code, it is essential first to know just what information the management is going to require. One manager will demand very amplified statements; another only summaries. One will insist on a certain charge being made to one process, and another man will want it under some other process. For example: One person will believe that shaft repairs should be charged to hoisting, and another person will think that the charge belongs under General Underground Repairs. I will say in connection with this subject that there has been agitated a move toward a standardization of costs along general lines, so that comparison between different organizations may be made correctly. To bring this about, the codes must be similar.

One of the large mining companies operating a number of branches in the Southwest had this problem to deal with a few years ago: Each branch sent to the general manager's office a monthly cost sheet, of which no two were alike, because their codes differed. The general manager naturally wanted to be able to make comparisons between the different branches, and he was able to do this only by standardizing the cost systems for all branches.

Continuing with our problem, the next step is to divide into processes the activities required to discover,

break, and deliver a ton of ore on the surface, and to define each process clearly, so that the employees whose duty it is to make the original charges will do so correctly. Our segregations of labor and supplies, which form the greater part of the basis of our costs, will then be right.

Mining Processes and Their Definitions

In a majority of cases, the processes are as follows:

I. *Exploration and Development*—This covers the expense of opening all drives, raises, winzes, shafts, and drill holes required to discover and develop all orebodies preparatory to stoping. To drives should be charged all the expense incurred to set up the machines, drill, and blast the rounds of holes. If dirt has to be moved to make room for the machines, the work should be charged to this account. Should the ground require timbering to make it safe for the men working in the faces, this expense should also be charged here. Subsequent timbering for the purpose of keeping the drives open and in good condition should be charged to General Underground Repairs. The removal of the ore or waste from the faces should be charged to tramming. Raises should be charged with all the expense of drilling, blasting, and timbering. To winzes should be charged all the expense of drilling, blasting, timbering, hoisting the dirt up to the level, and, if water must be removed, the pumping. The same charges apply to shaft sinking. Drill holes should be charged with all expense of boring them, and the moving of the equipment from one place to another.

II. *Stoping*—To this account should be charged all expense of drilling, blasting down the ore, and mucking it into chutes from the opening up of a stope to its finish. Timbering in the stopes, including the building and repairs of chutes and the subsequent filling with waste should also be included in this account. Likewise, where ore is hand-picked in the stopes, the labor of sorting out the waste should also be charged under the heading of stoping.

III. *Tramming*—To this account should be charged all expense of loading and tramming the cars from the points where the ore and waste originates to the dumps or shaft stations. Also, the repairs and extensions to track and trolley wires; the repairs to cars and motors; where mules are used, the expense of these animals; the building and repairing of transfer chutes and dumps; and whatever drilling and blasting is required for putting in switches and special track.

IV. *Hoisting*—To this account should be charged all expense of loading the cages or skips, the hoisting, and the disposal of the ore or waste on the surface. It also includes all repairs to the hoisting plant, headframe and ore bins at the shaft, signal systems, shaft timbers, and track and dumping equipment used in connection with the disposal of the ore and waste hoisted.

V. *General Underground Repairs*—To this account should be charged all expense of keeping open and in good condition all underground openings used as passageways, excluding shafts. Ladderways serving a stope should be charged to stoping.

VI. *Drainage*—To this account should be charged all expense of collecting the mine water in sumps, and the pumping or bailing, and the disposing of it on the surface. It should also include the cutting of special sumps and pump stations, the installation of pumps and pumping equipment, and the repairs to the same.

VII. *Ventilation*—To this account should be charged all expense of installing and operating fans, and the repairs to the same; the installation and repairs of doors, or similar contrivances, for diverting the air currents; the expense of opening and maintaining in good condition special shafts and other underground passages for ventilation purposes only; and the cost of compressed air used to blow out the gases from the working places after blasting.

VIII. *Sampling and Assaying* — To this account should be charged all the expense of taking samples, of operating and repairing the sample mill, and the expense of the assay office.

IX. *Miscellaneous Expense*—This account includes such expense as surveying and mapping, mine sanitation, mine office, employment office, safety first department, and other like agencies. It is sometimes advisable to include sampling and assaying, and also ventilation, instead of carrying them as special accounts.

Conditions, of course, vary at different mines. At some, there is no hoisting, and at others no water to handle.

These mine accounts will cover all direct mining charges. The indirect charges include such accounts as general expense, taxes, depreciation, and, in some cases, ore transportation.

Compiling Costs

In determining costs, a unit of some kind must be used. In mining, where development only is in progress, it is the foot advanced; where this stage has passed and the mine is on production, it is the ton of ore extracted and delivered.

In mining operations, ore is derived from three sources—stoping, exploration and development work, and general underground repairs, though in many mines the amount coming from this last is negligible.

The question of tonnages seemed to be confusing to the author of the article under discussion. The amount of ore broken differed from the amount trammed, and the amount hoisted was still another amount. What tonnage should be considered as a basis of the cost?

In making up costs, a statement should be compiled of each process, and a summary showing the total of each process, with its corresponding cost per ton of ore extracted. It is an excellent plan to show in addition, for comparison, the cost per ton of the previous month, and the average cost from the beginning of the year.

The statement for Exploration and Development should show the total amount expended during the month and the total footage advanced, by levels.

The statistics should show the cost per foot advanced, the footage per man-shift, and the pounds of dynamite and the number of board-feet of timber used per foot advanced.

If more than one system of stoping is used, the Stoping statement should show the costs and tonnages by systems, together with the cost per ton of ore broken, tons per man-shift, and the pounds of dynamite and the number of board-feet of timber used per ton. Unless the shrinkage system is used, the tonnage reported drawn from the stopes is a factor close enough on which to base these costs. In the operations in shrinking stopes, the tonnage broken should be calculated by actual survey. The idea of attempting to trace every individual ton of ore through the different processes from the breaking of it to its delivery on the surface, and attaching to it the costs, the same as a piece of

machinery in construction is routed through a foundry and machine shop in a manufacturing concern, is not practicable and need not be considered.

The output of a mine is classified under the continuous process, and not as piece work or job lots.

The unit of cost of Tramming should be the 1,000-foot-haul-ton, the actual tonnage (estimated by capacity of cars) handled being the amount used.

Hand tramming should be shown separately from electric, or from mule tramming.

In the Hoisting statement, the unit of cost should be the 1,000-feet-lift-ton, the actual tonnage handled being the one used. Where more than one shaft is in operation, it is a good plan to make up this statement by shafts.

The unit for Drainage should be a foot-gallon unit, such as lifting 1,000 gallons 1,000 feet.

The cost unit for Ventilation where a fan is used should be 1,000,000 cu.ft. of air delivered.

Under Sampling and Assaying, the information sought is the cost to cut, grind, and assay a sample of ore.

Under Miscellaneous Expense, the unit used might be a man-shift.

The information contained in these nine statements would show the mine superintendent what the work was costing by processes, and the summary would show the total cost of production and the corresponding cost per ton based on a ton of ore delivered. These monthly costs would be combined in making up the profit and loss statement at the end of the year.

The author of the article under discussion seemed to be at a loss as to just how certain charges should be made to operating expenses, and brings up those which belong under Exploration and Development. In my experience I have noticed that some companies charge all of this expense out monthly, irrespective of the amount of work done. Personally, I do not favor this procedure. The benefit derived from exploration and development work, considering it by levels, covers the period of time that each level is producing ore. The account should, therefore, be kept by levels as a Deferred Charge, and charged off over the estimated life of the different levels. The expense of sinking a shaft, or stripping off the overburden preparatory to steam-shovel work, should be handled the same way, based on the estimated life of the shaft or the orebody. I have in mind one large copper producer in the West that uses this method.

Another problem that seemed perplexing was the handling of additional new equipment. Now, equipment, such as cars, motors, air-drills, and the like, comes under capital assets, and, as such, the different classes should be carried in separate accounts under this group. A reserve for depreciation should also be set up for each class of equipment, and the amount charged off based on the life of this equipment. In the case cited in the article, the forty-nine cars should be carried in a separate account at cost price, and one-twentieth of this amount charged off each year to operating expenses, and credited to reserve for depreciation. If at the end of fifteen years the management finds it necessary to buy new cars, this can be done without affecting the account of the old ones. The new ones, no matter what they cost, would be carried in a separate account, and a proper amount charged off each year as depreciation.

When new equipment is bought to replace the old but still serviceable equipment, the procedure should be similar to that in railroad accounting as laid down by the Interstate Commerce Commission. The rule is the sum of the depreciation as of that date and the amount obtained from salvage should be deducted from the cost of the old equipment, if that amount be the greater, and the difference charged out to operating. When this amount is so large that its addition to operating expense would materially distort the cost per ton for that period, it may be spread over a number of periods.

Should the cost of the retired equipment be less than the sum of the depreciation and salvage, the difference should be credited to an appropriate income account, so that it may appear on the profit-and-loss statement at the end of the year under "Miscellaneous Income."

Regarding the handling of small hand tools, like shovels, the life of these is so short that it is better practice to charge them directly to operating, instead of to a capital account, carrying a heavy depreciation.

So much for mining.

We will now continue with our problem on the supposition that the company operates a mill in connection with the mine.

The procedure of installing a cost system in the mill is the same as in the mine. A code of accounts is drawn up, and the different processes are defined through which the ore passes from the time it enters the mill in the crude state until the finished product is delivered to the bins, in accordance with the flow sheet.

Here again the author is confused in starting off, thinking that the ore should come to the mill with the mining costs tacked to it, much the same as the system of handling raw material in a manufacturing concern, and using as a basis for costs a ton of the finished product. Instead of this, the information that the manager really wants, in a nutshell, may be shown in the following statement:

Value of ore per ton (average run of mine)		$10.00
Cost of mining per ton	$2.00	
Cost of milling per ton	1.50	3.50
Net profit		$6.50

Hence the basis for costs is the ton of crude ore.

In compiling the costs, statements should be drawn up that will show clearly the work that is being accomplished by each process.

Metallurgical methods have changed a great deal during the last decade. The introduction of flotation has revolutionized this branch of industry, and new inventions and new designs of machinery have brought about many changes. These changes are still going on, and it behooves the manager and the metallurgist to see that the costs are presented in such form that they may be able to determine where improvements may be made, resulting in greater savings and more profits.

Douglas, Ariz. IRVING H. WENTWORTH.

Credit to Frank L. Hess

THE EDITOR:

Sir—I regret that in the article on the geologic time scale, on page 778 of the Nov. 15 issue, the name of Frank L. Hess was omitted from the committee which is studying the possibilities of estimating the age of radioactive minerals. He is an expert in these minerals, and is not only one of the best qualified members of the committee but has been most active in collecting the necessary material. ALFRED C. LANE.

Boston.

Diamonds in Brazil

THE EDITOR:

Sir—I have read with interest the article by Mr. Garrison on diamonds in Brazil, in your issue of Sept. 24, 1924, page 491. I have twice examined a part of this country, in 1909 that to the north of the known fields in Bahia, and again in 1911 around Lencoise, Andryhea, and Victoria. These places appeared to be the center of the most productive areas at that time. My investigations were with a view to dredging, or some method by which a reasonable profit might be earned. My conclusions were that dredging was not possible in the areas under examination, because of the presence of too many large boulders and hard bedrock with large crevices and low values. The only method that seemed possible was that used by the native concessionaires: this was tributing. A small profit was being earned in this way, but not enough to be attractive to investors.

The diamonds occur in sandstone, quartzite, and conglomerate.

It is a mistake to assume that the natives have been unable to reach bedrock, in the sumberged areas, for I have seen it done, and though their methods were slow and crude, taken all in all they were not too bad. Where the ground was about 35 ft. deep their way was about as shown in Fig. 5, page 495; by the use of stakes, palms, and bamboos and by a great many men hand bailing they would finally get down. The surface diameter of the pit would about equal the depth, and only 4 to 6 ft. of bedrock would be cleaned. In favor of this method was its flexibility and small initial investment.

Costs per foot on preliminary work were much less than by machine drills, for all material at that time was taken in on pack animals.

Difficulties are not so great if one speaks the language and understands the people, and realizes that it is their country, and uses a little diplomacy. Many foreign engineers seem to think the way to impress the native and show their importance is by being arbitrary, but they only succeed in antagonizing him. No matter what the laws or regulations are, there is some way to arrive at a suitable adjustment. This sometimes is such that the foreigner loses, but usually it is his own fault and in some instances is due to too much haste.

London. W. E. THORNE.

Is Sulphur Recovery from Smelter Gases Profitable?

THE EDITOR:

Sir—Your editorial in the Nov. 1 number of the *Journal-Press* gives some interesting instances of the economies that are being effected by more fully utilizing byproducts.

Coming to sulphur, however, not in the elemental form but as sulphur dioxide, we are reminded that we are certainly a long way off from "utilizing everything except the squeal of the pig," although there is no desire to recall any unpleasant recollections of the howls of ten years ago around Balaclava and other California smelters. But unless sulphur dioxide is available in fairly concentrated form, it is shot up through a modernized Tower of Babel into the higher atmospheres, where, as it is no longer smelt, it is promptly forgotten. Yet its possibilities are not slight. Reduced, as sulphur, it may be obtained in the precipitated form and as such is thought to have a greater fertilizing value than ground sulphur.

Since the Thiogen days and the rise of Frasch sulphur, the recovery of the element from smelter gases has been considered uneconomical. Yet it can be demonstrated that a ton of sulphur in the Mississippi Valley can be produced for little more than the cost of coal per ton and at about a proportionate cost at such distant points as Canada. This sulphur may be used in all the arts.

It would be interesting to have opinions as to whether its recovery from smelter gases is really considered profitable under present conditions.

East Orange, N. J. E. V. ESPENHAHN.

Quicksilver a War Necessity, So Deserves Tariff Protection

THE EDITOR:

Sir—The oldest quicksilver mine in the United States would like to add a short word of reply to the matter of a tariff on quicksilver, referred to in an article in your Sept. 27, 1924, issue, appearing under "Washington News." That article has been ably replied to by two well-known quicksilver producers in your issue of Nov. 1. There is little additional argument to present in defense of the present tariff of 25c. per lb., but it *is* pertinent to emphasize the vital necessity of such a tariff, inadequate as it really is.

Opponents of this tariff should ignore the hackneyed argument that a small industry is protected and that the burden lies heavily on the general public; an argument which, by the way, is not supported by facts. Those facts are summarized in the two replies referred to above; and may be substantiated by the source of (official) information—namely, the *Congressional Record*, Vol. 62.

What *should* be considered by opponents of the quicksilver tariff, irrespective of any possible advantage it has to the producer and his employees, is its vital effect of aiding to keep the industry alive in the United States. Quicksilver is the most important of war necessities. It is a *prime unsubstitutable* necessity. Without quicksilver not a gun could be fired. That fact should sink into one's mind very deeply, since science has not discovered a satisfactory substitute for quicksilver in the manufacture of fulminate of mercury.

In conclusion, permit me to quote from a letter addressed to the Ways and Means Committee, July 15, 1921, by John W. Weeks, Secretary of War, whose opinion is certainly worth being carefully considered by every intelligent citizen, if not actually heeded:

> "The War Department is of the opinion that in order that the needs of the country in war may be met from the resources available in the United States, governmental protection of the quicksilver industry in time of peace is essential, and it is, therefore, recommended that such a tariff be placed upon imports as may be considered necessary by the Congress to enable this industry to be operated on a profitable basis in time of peace in order that it may be maintained in a condition to meet the needs of the country in time of war."

GEORGE H. SEXTON,
President The New Almaden Company, Inc.
San Francisco.

Consultation

Arsenic Smelters

"Please send me a list of smelters and refiners in the United States, Great Britain, and the Continent who buy or refine arsenopyrite or auriferous mispickel. Also a list of the largest producers and users of white arsenic and its products. I understand there is a strong demand for arsenical ores in England, Belgium, and Germany. Where can I obtain information about this market?"

The principal smelters and refiners of arsenical ores in the United States, who are also the largest producers, include the Anaconda Copper Mining Co., Anaconda, Mont.; the American Smelting & Refining Co., Tacoma, Wash., Murray, Utah, and Denver, Colo.; the International Smelting Co., Tooele, Utah; the Jardine Mining Co., Jardine, Mont., and the Keystone Arsenic Co., Keystone, S. D.

In Canada, the principal producers are the Consolidated Mining & Smelting Co., Trail, B. C., and the Deloro Smelting & Refining Co., Deloro, Ontario. The principal buyers of white arsenic are the insecticide manufacturers and concerns that make weed killer of this material. Some is also sold to drug manufacturing firms. The market for white arsenic just now is very stagnant indeed, and producers are unable to find any wide demand for it, the quotation being nominally 6½c. per pound. We have not heard of any strong demand from Europe for arsenical ores.

Manganese Ore Calculations

"In the *Engineering and Mining Journal-Press*, page 479, of Vol. 118, No. 12, under the head of market quotations for Metallic Ores, appears the following quotation.

" 'Manganese—42@46c. per long ton unit, seaport, c.i.f. Nominal.'

"I take it for granted that the sign '@' is meant for the word 'to,' so that the reading would be 42c. to 46c. Under this quotation as given will you kindly let me know what a long ton of manganese ore, of 45 per cent manganese contents, would be worth at seaport, or, say at Pittsburgh?

"Four assayers of this city, and two mining engineers, from this quotation have figured the price as follows: Forty-five per cent manganese ore at 42c. per unit equals $18.90. These people cannot seem to apprehend that a ton or a long ton unit is not the same thing as a unit, referring to 1 per cent of the metal content.

"One prospector, two parties who during the war time handled and sold manganese ore, one assayer, and the gentleman in charge of the Branch State Mining Bureau give the result of the quotation as follows:

" 'A unit of a long ton is 22.4 lb., and there are contained in each such ton one hundred units. As each such unit is quoted at, say, 42c., then one ton or one hundred units is worth one hundred times 42c., or $42.'

"One of the buyers or past buyers of this material gives me to understand that the unit of 45 per cent manganese content is the standard to figure on when quotations such as appear in the one mentioned are given. From a quotation I saw in a chemical journal I judge that a 50 per cent content is the one standard now in vogue. Kindly set me right in this matter and let me know what is the lowest per cent content that would be accepted by the present buyers."

With manganese ore quoted at 42@46c. per long ton unit, seaport, c.i.f., a long ton of manganese ore of 45 per cent manganese content, at seaport, would be worth from $18.90 to $20.70. This is obtained merely by multiplying 45 by 0.42 or 0.46. This is a simple means of ore valuation.

A unit is merely 1 per cent. A long ton unit is then 22.4 lb. A long ton of 45 per cent manganese ore would contain 2,240 × 0.45, or 1,008 lb. of metallic manganese. This, divided by 22.4 (the number of pounds to a unit), gives 45 as the number of units of manganese in a ton of ore. As the price is 42c. per unit of Mn, the value of the ore is, as already mentioned, 45 × 0.42, or $18.90. This is explained in W. R. Crane's article on the marketing of manganese, *E. and M. J.-P.*, Aug. 26, 1922.

There is now a duty of 1c. per pound on the manganese content of manganese ores. The duty and the freight to destination is customarily paid by the buyer. A Pittsburgh consumer, therefore, assuming the quotation is 42c. per long ton unit, c.i.f. seaport, would have to pay $18.90 plus the duty of (2,240 × 0.45 × 1c.) or $10.08, plus freight to Pittsburgh, say $3 per ton. This totals about $32 per long ton.

Ore containing from 45 per cent of manganese up is acceptable to buyers. The high grades naturally command a premium because of their purity. Ore containing 35 to 45 per cent managanese is ferruginous ore. If it contains 5 to 35 per cent manganese it is called manganiferous iron ore. Ore with less than 5 per cent manganese is not classed as a manganese product.

Is Jigged Ore a Concentrate?

"Will you kindly advise me as to whether jigged ore is considered a milled ore or concentrate?

"I have a manganese property leased, and my contract provides that I shall be paid a 10 per cent royalty on all smelter ore and a 5 per cent royalty on all milled ore or concentrates.

"The ore is not run through a mill or crushed, but is screened as it comes from the mine, and the fines are separated by this process, and run through a jig to clean them of the rock. The ore is not incorporated in the rock.

"I shall appreciate it if you will give me an opinion or cite some court decision, as no doubt this question has been passed upon by the courts."

The product of your jigs is probably a concentrate, even though it has not been passed through a crushing machine. You could, therefore, command only a 5 per cent royalty from it. We cannot cite any court decision to support this opinion, but the publication of this question and our answer may draw an interpretation from some of our readers who may have had legal experience with such a matter.

Control of Ore Stockpiles

Can any of our readers aid this correspondent in his problem?

"In the chemical industry it is often quite a problem to keep control of materials purchased in bulk and parceled out in smaller lots. I am interested in obtaining information on accounting for bulk materials, and believe that some of your readers may be able to supply interesting data on control of weights and analysis of ore stockpiles."

News of the Week

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Summary

THE Aluminum Ore Co., a subsidiary of the Aluminum Company of America, has acquired the mines and mills of the Fairview Fluorspar & Lead Co., and of the Kentucky Minerals Holding Co. in the Illinois-Kentucky fluorspar field.

An 8-ft. shoot of good ore 4,000 ft. below the apex has been cut in a drift from the Star crosscut in the Coeur d'Alene district of Idaho.

The Provincial Government of Ontario has announced that it will pay a bounty of 1c. per unit on iron ore produced in the province.

With 153 mines in operation, production of zinc and lead in the Joplin-Miami district has been increased.

At Pioche, Nev., the Prince Consolidated has taken over the Virginia Louise property and will push development.

The Federal Mining & Smelting Co. will line with concrete a section of the shaft in its Morning mine at Mullan, Idaho. The shaft has been difficult and costly to maintain.

Iron mining in Michigan is improving. Pickands, Mather & Co. has resumed production at three of its mines.

The Miami Copper Co. has appropriated $800,000 to improve and increase the capacity of its concentrator at Miami, Ariz.

Michigan copper interests appear to be alone in their advocacy of a copper tariff, says our Washington correspondent.

During September the Engels Copper Co. made metal for 10.99c. per lb.; 10c. is expected to be reached early in 1925.

Michigan Iron Mining Looks Up Following Election

Pickands, Mather & Co. Recently Reopened Three Mines; Add Shifts at Others—Outlook Better

Iron-ore mining on the Michigan ranges has shown marked improvement since the election of Nov. 4 and a number of properties which were idle have been opened since that day, while a number of others have received orders to increase output. Late orders were received at several mines for ore this season and they are now busy making shipments to the lake ports. One company received an order for 100,000 tons the day following the election.

Pickands, Mather & Co., now the largest independent operators in the Lake Superior region, have issued orders to reopen the Fogarty, Baltic and Buck mine, in Iron River; the Warner, at Amasa, and the Carey, at Hurley. All of these mines have been on the idle list since early last spring and it was thought that they would remain so until early next year. The Rogers, Brown Ore Co. has resumed the mining of iron ore at its Rogers mine.

In addition to opening mines which were closed, Pickands, Mather & Co. are now operating their Palms-Anvil mine, at Bessemer, and the Newport, at Ironwood, on a full-time basis. Both mines, which are among the largest underground properties in the Lake district, worked only four days a week since last June. The Montreal mine, Montreal, Wis., has gone on a two-shift basis, after working only one shift all summer. The same company has added an extra shift at its Eureka mine, at Ramsay. The headframe at the latter property was recently destroyed by fire, but since has been replaced.

The outlook for 1925 is highly encouraging and it is thought that some of the other mines now working on short schedules will shortly increase their forces and that some of the other mines that are inactive will resume.

"Pull" First Ore Through Inspiration's New Shaft

HOISTING of ore at the Inspiration Consolidated Copper Co.'s new Porphyry shaft at Miami, Ariz., started on Nov. 22. Production will start at 1,000 tons per day and will gradually be increased to 2,000 tons daily in a period of ten days. Within six months it will be possible to hoist 10,000 tons per day in two eight-hour shifts. The 300 men who are now working on development and construction at the new shaft will now be placed on production work. To operate the shaft at capacity a crew of 600 men will be required. The shaft serves the Live Oak division of the company's mine.

Active Mines in Joplin-Miami District Total 153

Good Prices for Concentrate Stimulate Operations—Golden Rod Resumes at Three Properties

Operations are being pushed in the Joplin-Miami field, as a result of the encouragement of better zinc ore prices. A total of 153 mines were reported in operation, full or part time, last week, which comes within one being as many as ever were operating here at one time. However, comparatively few companies are operating night shifts.

The Golden Rod Mining & Smelting Co. started operations at three of its properties last week, the Goch, Jefferson and Baxter Springs mines.

The Quapaw Mining Co., a Charles M. Schwab concern, has taken over a lease on the 120-acre tract known as the Maxine and Buffalo lands, located just west of the Royal mine of the United Zinc Smelting Co.

The Skelton Lead & Zinc Co. has completed the rebuilding of its No. 5 mill, which was destroyed by fire several months ago, and has placed it once more in operation.

The American Zinc Co., a subsidiary of the American Zinc, Lead & Smelting Co., has taken over the Douthat lease, formerly known as the Skelton No. 2, and is moving the old Unity concentrator from Oronogo, Mo., to the site. It will be ready for operation about the middle of December.

Star Drift Cuts Ore Shoot at 4,000-Ft. Depth

Production from Famous Coeur d'Alene Mine to Start Soon—Lead Content Higher than in Upper Levels—Zinc Concentrate May Go to Anaconda

ANOTHER great mine is on the verge of entering the list of producers in the Coeur d'Alene district, Idaho. This is the Star, owned by the Sullivan Mining Co., the stock of which is owned half and half by the Bunker Hill & Sullivan and the Hecla Mining companies. After three years of continuous and expensive development work, the Star ore shoot has been reached at a depth of around 4,000 ft. below the apex of the vein. The ore was struck after drifting east 330 ft. from the intersection of the vein by the famous Star crosscut driven practically two miles from the shaft on the 2,000 level of the Hecla mine. Where the vein was cut there were three widely separated fissures, but no ore. The crosscut was continued about 1,000 ft. to a second vein known as the San Jose and this also proved to be barren. Drifting then started east on the Star vein. It was estimated that it would be necessary to run 800 ft. to reach a point beneath the west end of the ore shoot where it had been proved for 1,000 ft. in a drift from the 1,800 level of the Morning mine. Striking it almost 500 ft. in advance of that point indicates that the shoot will be 1,650 ft. in length, that being the distance to the common end line of Star and Morning. The ore is 8 ft. wide and shows a marked increase in the amount of lead as compared with zinc. Another gratifying feature is that the lead and zinc are not closely combined and can be separated by the usual methods of concentration.

The striking of this ore proves beyond question a tremendous tonnage in the Star, for the ore has been proved on various levels from the Morning mine. Its development from this deep level will proceed rapidly and within a few months the mine is expected to be productive. The new plant at the Hecla, which replaced the one destroyed by fire, was planned to meet all requirements for the operation of the Star as well as the Hecla, and the Bunker Hill & Sullivan has a mill at Kellogg for the treatment by concentration of the Star ore.

It is believed that the strike on the Star will also result in the construction of an electrolytic zinc reduction plant at Kellogg by the Bunker Hill & Sullivan company, although the increased amount of lead in the ore as well as the change in its character may cause the Bunker Hill to adopt other plans. If the zinc plant should be built, the Tainton process would be used, as it has proved very successful in treating Star ore in an experimental plant at Kellogg. However, it is known that the Anaconda company is very desirous of increasing its supply of zinc from the Coeur d'Alene district for the Great Falls plant, and it is possibly that the Bunker Hill & Sullivan might find it desirable to ship to Great Falls rather than make the large investment necessary for a plant of its own.

Another Gold-Copper Prospect Looms in Quebec

Another rich copper-gold-sulphide deposit, similar in character to that of the Horne property in Rouyn township, Quebec, is reported from northwestern Quebec. The property is owned by the Amulet Gold Mines, Ltd. and to date nothing but a comparatively small amount of surface work, has been done, but the new discovery has been proved for a width of 60 ft. and for a length of 275 ft. Assays show gold and copper values of $35 over 37 ft., in one place, and $47 over 20 ft. in another. Other assays from portions of the exposure which appear to be the richest, gave assays varying up to $70. Development will be continued.

Scales Syndicate Acquires Placer Ground in California

The Scales Syndicate has acquired additional placer and hydraulic ground tributary to the Bullard's Bar dam on the North Fork of the Yuba River. The area is largely in Sierra County. The flow of Slate and Canyon creeks has been secured. The old placer properties are known as Poverty Hill, Secret Diggings, La Porte, Belvieu, Gibsonville, Hepsie Dam, Howland Flat, Scales, Iowa Flat, Bunker Hill, Port Wine and St. Louis.

Will Drill Tract West of Seneca, Mo.

An effort to locate profitable zinc-lead orebodies on a tract about 6 miles west of Seneca, Mo., south of Joplin, is to be made by the Joy Prairie Mining & Development Co., recently organized in Joplin by H. E. Taylor and associates. Mr. Taylor himself owns 240 acres of land in the vicinity, in which prospecting is to be carried on, and the company has leased, in addition, about 2,500 acres. It is planned to get drilling actively under way by Dec. 15.

United States S. R. & M. Co. Get Judgment for $257,000

Speaking through Justice Butler, the U. S. Supreme Court on Nov. 17 affirmed th decision of the Circuit Court of Appeals in the suit of Frederick Y. Robertson, for the Mammoth Copper Mining Co., subsidiary of the United States S. R. & M. Co., against the Alien Property Custodian, representing German owners of Beer, Sondheimer & Co., for breach of contract. The issue involved non-acceptance of zinc ore from California mines of the Mammoth company. The verdict of $257,000 was affirmed, with interest from 1916, the Supreme Court holding that war did not intervene as an excuse for not paying interest.

Will Concrete Section of Morning Mine Shaft

Federal M. & S. Co. Hopes to Lessen Expense of Maintaining Hoist-way —Improvement in Concentration by Flotation

The Federal Mining & Smelting Co., of Wallace, Idaho, will pay a dividend of $1.75 per share on Dec. 15 on its 120,000 shares of preferred stock, amounting to $210,000. The same amount was paid in the three preceding quarters this year, making the total for the year $840,000. Changes in the Morning mill during the year by which nearly complete mineral recovery is accomplished by flotation has resulted in a higher grade shipping product and a reduction of loss in the tailings to the minimum. The Morning mine is the chief source of income for the Federal, although the company is engaged in extensive and profitable zinc production in Oklahoma.

On the deepest level of the Morning, the 2,450, which is 1,650 ft. below the main operating tunnel, the great ore shoot has proved to be of as good or better grade and equally as extensive as on the levels above. The shaft has been extended to the 2,650 level and a crosscut will soon be run to the vein, where the same satisfactory showing is expected. The Morning has always had much trouble with the shaft on account of ground movement, and keeping it in alignment for safe operation has been a heavy expense. As the shaft grows deeper the expense and difficulty of keeping it in shape increases, and the management has therefore decided on an interesting experiment to overcome the trouble. Below the 2,650 level, where it will not interfere with operations, a section of the shaft 40 ft. in height is being constructed of concrete. Much care will be exercised in preparing the mixture, and around the shaft form the concrete will be poured filling the entire space to the surrounding rock.

There are two theories regarding the couse of the shaft trouble. One is that it is a massive earth movement that nothing can withstand, and the other is that it is a breaking and cracking of the rock caused by exposure to the air, without much violence. If it is the latter, the concrete will certainly hold it. and it may hold it even if it is a ground movement, for the concrete will be as solid as the rock itself. The concrete section will be given a thorough test, and if it proves successful the entire shaft will be reconstructed of concrete.

U.V.X. Manager Denies Report of New Ore Find

With reference to the many recent reports relative to the discovery of new ore in the mines of the United Verde Extension at Jerome, Ariz., George Kingdon, general manager of the company, has issued an official denial. He states: "Upon the 1,600 level we have drifted through a body of iron pyrite which we had hoped would prove of such character as to be a desirable flux for our smelter operation. It all contains copper, but not commercial ore."

Prince Consolidated Takes Over Virginia Louise at Pioche

New Turbo-Generators Being Installed —Will Unwater Mines to 850 Ft.— Combined Metals Ships Regularly

The Prince Consolidated Mining Co., of Pioche, Nev., has recently taken over the adjoining Virginia Louise mine and is now engaged in installing additional equipment of greatly increased capacity. The Prince mine will be unwatered, and development of the ore-beddings indicated below water level will be resumed. The new equipment consists of two turbo-generators of 600 and 400 hp. which will be used in connection with the present boiler plant, and two electrically driven Byron-Jackson centrifugal pumps, having a 1,000-g.p.m. capacity.

Actual unwatering of the mine is expected to begin on the first of January. The cement work is now complete and all the machinery is on the ground. Proposed development includes a 1,000-ft. drift which will be run under the present Virginia Louise workings and will be approximately 300 ft. under the territory from which the present shipments, at the rate of 100 tons daily, are being mined. As a consequence both the Prince Consolidated and Virginia Louise mines will be opened up to a vertical depth of 850 ft.

The Combined Metals Co., is now shipping 200 tons of silver-lead-zinc ore to its mill at Bauer, Utah. This week the bedded ore was struck on the 550 level of the mine, thus greatly adding to the existing tonnage. High-grade ore is also being sacked on the 650 level. This ore occurs in the Raymond and Ely main fissure and is an entirely different orebody from that worked in the main bedded veins.

Poles are now being set for the power line from the Prince mine to both the Comet and Highland districts, where properties under the management of Squires & Gemmill are situated. Repairs are almost complete at the Comet mill, while the Mendha mill is operating successfully and turning out a high-grade concentrate for shipment to Salt Lake smelters.

Magma Copper Co. May Sell Railroad to Southern Pacific

In a recent interview in El Paso, it is reported that Colonel William Boyce Thompson, president of the Magma Copper Co., declared that he is planning to sell the Magma Railroad to the Southern Pacific. The Magma Railroad connects the town of Superior with the line of the Arizona Eastern, running between Phoenix and Winkelman, which was recently included in the roads merged with the Southern Pacific. The Magma company last year changed its road from a narrow gage to standard gage, in order to facilitate the handling of ore cars.

In the course of the interview, Colonel Thompson stated that he believes there is prosperity ahead of southwest copper production, if the companies do not produce more than the market can absorb.

There Are More Ways Than One of Getting "Salted"

SENATOR O. W. SPARKS, of Galena, one of the best known operators in the Joplin-Miami district is convinced there is nothing to the hope that a new zinc mining field was about to be opened up in the vicinity of Oswego, Kan. It happened this way:

When reports of the finding of zinc-bearing rock in an old well near that town were first brought to Galena, Sparks was one of the first to hustle to the Kansas town and get leases. He was lucky enough to obtain a lease on the tract where the original "discovery" was reported. He brought in a drill and put down a drill hole. No results. He put down another. Same thing. When a third attempt still resulted in showing absolutely nothing in the way of mineralized rock, he made a cursory geological survey of the neighborhood and discovered that the M. K. & T. Railroad had brought in a quantity of Galena chats a number of years ago for ballast for its tracks, a short distance from the tract where ore was suspected. It was enough for Sparks. He is convinced the promise of the "promising new field" originated in his own home town—possibly from one of his own mines at Galena. He has brought his drill back to this district.

Alta Merger Drains "Gold Ore" Zone in Utah

The management of the Alta Merger Mining Co. of Alta, Utah, reports improved conditions in the South Hecla portion of the property. Water, which in the summer interfered with operations, has been drained away, and work in what is called the Gold ore zone on the Dwyer tunnel level can be carried on to better advantage. Regular shipments are expected to be made throughout the winter.

B. C. Court Orders Lease of Ligtning Creek Placers

On Nov. 13, in the British Columbia Superior Court, Justice D. A. McDonald accepted the offer of the Northwest company, of Seattle, to lease the Lightning Creek Gold Gravels & Drainage Co.'s mine, in the Cariboo district of British Columbia. The offer provides for the payment of $2,000, due to the Provincial Government for rental, and $9,000, expense incurred by the receiver. Three miles of leases on Lightning Creek are to be mined and the lessee is to pay all operating expense and to receive 25 per cent of the gold recovery. Failure to comply with the terms will result in the forfeiture of all moneys expended.

The order of the court marks the end of a bitterly waged legal fight between two groups of the Lightning Creek company's shareholders, the one represented by J. S. Hogan, of New York, and the other by C. H. Unverzagt, of Seattle.

Peñoles Mining Co. Installs New Equipment at Mapimi

The Peñoles Mining Co. is installing new machinery, including larger pumps, in its Ojuela mines, in the Mapimi district, State of Durango, Mexico. It is making regular shipments of a large tonnage of ore to the smelters in Monterey and Torreon. At a recent meeting of the board of directors of the company held in Monterey a dividend of 1½ pesos was declared for payment in December.

Claim-Stakers Flock to Crow Springs, Nev.

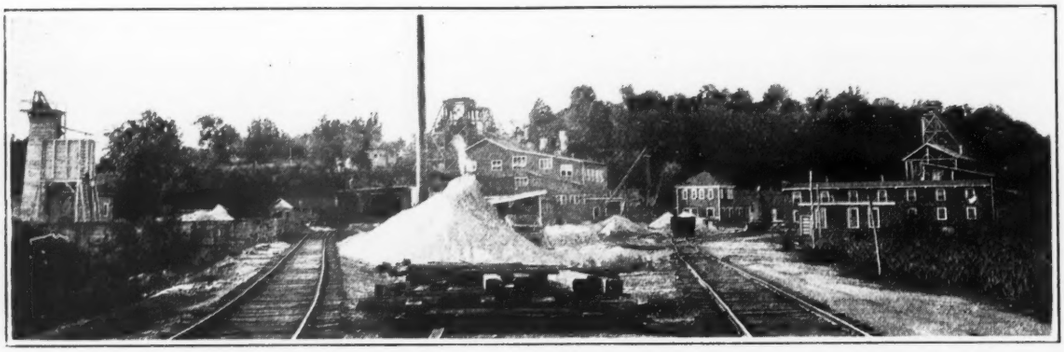
Shaft and Crosscut Yield $26 Shipment —Rhyolite Dike Traverses Area —Values in Gold

A new and promising gold strike has been made 29 miles westerly from Tonopah, Nev., in the Crow Springs district. While the strike is new the district is not, as the Carrie mine, a small lead-silver producer some years ago, is only a mile to the south, and many location holes in the immediate vicinity indicate past interest which faded due to lack of a stimulating find. The new strike was made by the Gilbert brothers, who have been prospecting this territory for years, on the west side of a prominent rhyolite dike which outcrops fairly continuously for a mile or more in a rolling mountainous country.

Rich placer gold pannings can be obtained for a distance of 500 ft. below and paralleling the dike. The Gilbert brothers have sunk a shaft 26 ft. deep, and have run a drift or crosscut 20 ft. from the bottom of the shaft work is continuing.

The first ore shipment represented all the material taken from the shaft plus a few tons of dirt which happened to be handy for the shovelers when loading the trucks, and returned $26 per ton, practically all in gold. Another shipment will be ready in a few days. So far no definite walls or boundaries to the ore have been found, but the limited work done would indicate the possibility of a considerable tonnage of ore of like grade to that which has been shipped. Values appear to be in highly silicified altered rhyolite breccia, which seem to have a general north strike and unknown dip.

Prospectors are flocking in from all over southern Nevada and near in ground is well staked, with locations extending for several miles. The owners of the original strike are placing their interests in a new company and are considering leasing the most promising ground in small blocks, in which event much may be known of the nature of the new discovery within a short time.



Concentrator and, behind, the main shaft of the Fairview company at Rosiclare, Ill.

Aluminum Company Buys Important Fluorspar Mines in Illinois and Kentucky

Gains Dominant Position in Industry—Vendors Are Fairview and Kentucky Minerals Holding Companies

By A. B. Parsons
Assistant Editor

TRANSACTIONS closed at St. Louis on Nov. 17 make the Aluminum Company of America, generally known as the Aluminum Trust, a dominant factor in the fluorspar mining industry of the United States. Through its subsidiary the Aluminum Ore Co. it has acquired one of the three large mines in the Illinois section of the Illinois-Kentucky fluorspar field and about fifteen smaller properties in the Kentucky section. The vendors are the Fairview Fluorspar & Lead Co. and the Kentucky Minerals Holding Co. The mines and mills of the latter have been leased and operated during recent years by the Kentucky Fluorspar Co., the largest producer on the Kentucky side of the Ohio River.

The Aluminum Ore Co. has for several years owned the Haffaw mine, in Kentucky. Fluorspar is shipped to East St. Louis where artificial cryolite is prepared for shipment to the various eastern plants of the parent company where bauxite ore is reduced to produce aluminum. Iceland is the chief source of natural cryolite, but the Aluminum company, using fluorspar and some bauxite, can make the artificial product more cheaply. Following their policy of making themselves independent, as far as possible, as to sources of raw material, the Aluminum company interests have been negotiating for a long time with the owners and lessees of various fluorspar mines in this field. The recent purchases are the fruit of these negotiations.

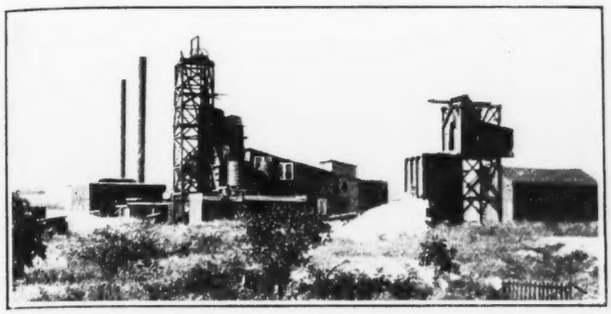
During 1923 the Illinois-Kentucky field accounted for 110,000 of the 121,000 tons of domestic fluorspar shipped from mines in the United States. Some years ago a survey of the producing and potential fluorspar properties of the western states, made by the U. S. Bureau of Mines, revealed the fact that the available supply of high-grade spar was comparatively small, at least until economical transportation from isolated districts was provided or prices for the product rose materially. The reserves in Illinois and Kentucky on the other hand are very large. The Illinois mines and mills are served directly with railroads and the highway haul from none of the Kentucky properties exceeds about 15 miles. Accordingly the acquisition of an important share of the mines puts the Aluminum company in a dominant position in the industry.

The largest property is the Good Hope mine and mill of the Fairview company situated at Rosiclare, Ill. Steeply dipping well defined veins varying in thickness from 30 ft. to 2 ft. are worked by shrinkage stoping with modern electric mine equipment much as western gold or lead deposits are

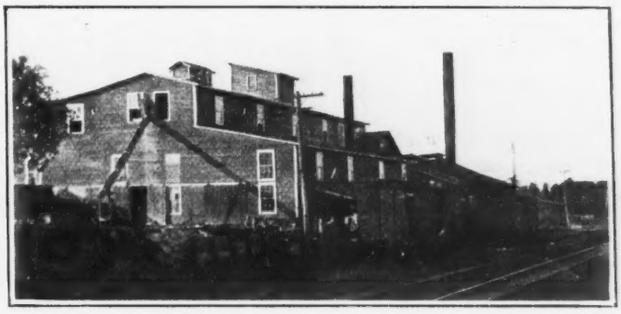
A typical Kentucky fluorspar mine plant: at the Susie Bealer

The Tabb or Hoosier mill, one of the largest on the Kentucky side

The Haffaw mine, the Aluminum company's original property



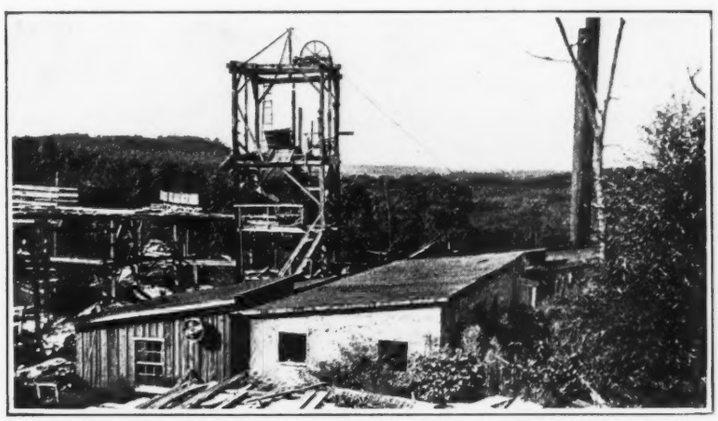
The Franklin mine in Kentucky. One of the Fairview properties



Kentucky Fluorspar Co's. concentrator at Marion, Ky.

worked. The deepest shaft is 500 ft.

On account of the flooding of the mines by seepage from the Ohio River at certain seasons the company has sunk its last two shafts in the solid country rock away from the vein. Concrete bulk heads in crosscuts to the vein permit isolating of the shaft and pump stations so that rapid unwatering can be accomplished after a flood.



The Mary Belle, another of the Kentucky Fluorspar Co.'s mines

The modern mill shown in the accompanying photograph has a capacity of 50 tons per hour. Specially made washers are followed by picking belts for sorting out high-grade "lump," crushers, rolls, jigs of the Joplin type, and concentrating tables, by means of which various grades of "gravel" spar are recovered. In 1922 the average value of gravel spar was $16.36 compared to $18.56 for lump. In 1919 the corresponding figures were $23.80 and $30.38, and in 1913, $5.87 and $6.88. The high price of 1919 was an aftermath of the war. A byproduct is a concentrate containing 80 per cent lead and 8 oz. silver per ton.

W. C. Bohn, has been general manager for the Fairview company for many years and under his competent direction both mining and milling processes have been developed to a high degree of efficiency.

The Fairview company also owns the Franklin mine, on the Kentucky side of the river, and it is included in the recent sale. Among the mines owned by the Kentucky Minerals Holding Co. are the Pogne, Ada, Florence, Beard, Wheatcroft, Hodge, Yandell, Susie Bealer, and Mary Belle. There are two washing plants of fair size, the Tabb or Hoosier, situated at the Hoosier mine, and another plant at Marion, which is the railroad point for the Kentucky fields. Most deposits so far developed are small and superficial compared with those across the river, but the area is a large one and the aggregate available supply is immense. Gravel spar, washed in small plants, is the principal product. The Haffaw mine of the Aluminum Ore Co. has been opened to greater depth and an orebody 75 ft. wide in places has been developed.

About 75 per cent of the fluorspar produced is used in the open hearth steel plants and it is understood that certain steel companies are interested in the other two large companies that operate in the Rosiclare district. Surprise is expressed in some quarters that the steel interests allowed the Aluminum company to outbid them for the properties that recently were sold, but there is no reason to believe that the steel companies are not fully alive to the situation. It looks as though fluorite may not be as important in the making of steel as in the making of aluminum.

Will Reopen Rawhide Mine

The Marne-California Mining Co., incorporated in Nevada, has been formed to reopen the Rawhide mine at Jamestown, Calif. and the properties of the Marne Divide Co. near Grass Valley. Plans are under consideration to unwater the Rawhide shaft and install an electric hoist. G. F. Snyder is manager of the company's operations.

Mabel Mine Produces $85 Ore

The West End Consolidated Mining Co. has completed preparations for winter operation at its Mabel mine, 20 miles from Mina, Nev. Development work is being done on the 400 and 500 levels, and stoping from above the 300, 400 and 500 levels. One car of ore was shipped during October, the ore averaging $85 per ton in gold, silver and lead, the principal values being in silver. Another car is being loaded and will be shipped during the latter part of November.

International Will Smelt Old Dominion Ore

The Old Dominion smelter, at Globe, Ariz., which has been in operation some twenty years or more, will be shut down at the end of November, according to a recent announcement made by W. G. McBride, manager of the company. All ore formerly treated in this smelter will be sent to the International smelter at Miami. Concentrate produced by the Old Dominion has always been shipped to Miami, only direct smelting ore being smelted at the mine.

Mr. McBride states that the depression of the copper market and the lessening of ores suitable for treatment in blast furnaces are the reasons for the change. The more economical method of treatment employed at the International smelter will result in a saving which may lead to additional improvement work at the mine.

The men formerly employed in the smelter will be shifted to other employment by the company so that the closing of the smelter will have little effect upon the business of the community.

Trail Ore Shipments

Ore shipments to the Trail smelter of the Consolidated Mining and Smelting Co. of Canada for the period Nov 1 to 7, inclusive, were as follows:

Name of Mine	Locality	Tons
Cork Province, lead	Zwicky, B. C.	31
Greenwood smelter	Greenwood B. C.	30
Knobhill	Republic, Wn	117
Lucky Thought, lead	Silverton, B. C.	36
Molly Hughes	New Denver, B. C.	5
Ottawa	Slocan City, B. C.	8
Paradise	Lake Windermere, B. C.	48
Queen Bess	Alamo, B. C.	85
Ruth	Sandon, B. C.	44
Silversmith, lead	Sandon, B. C.	90
Silversmith, zinc	Sandon, B. C.	104
Standard, lead	Silverton, B. C.	44
Standard, zinc	Silverton, B. C.	94
Van Roi, zinc	Silverton, B. C.	50
Company mines		8,859
Total		9,645

London Letter

By W. A. Doman
Special Correspondent

Still Higher Rate of Copper Production from Katanga

Expected As a Result of Erection of New Plant by Minerals Separation Engineers

London, Nov. 11—In connection with the advance in the shares of the Tanganyika Concessions, which holds so large an interest in the Union Minière du Haut Katanga, it is stated that Minerals Separation has devised a treatment for certain of the ores, and is now about to undertake the erection of a plant. This is expected greatly to increase the already large output of copper, now at the rate of 100,000 tons per annum. One little disadvantage at present where the Tanganyika is concerned is that even if the operating company, the Union Minière, should declare a bumper dividend, it will be in Belgian francs, and these have to be converted into sterling, thus causing a heavy loss on exchange. The Union Minière is soundly managed from the financial aspect, and makes ample provision for depreciation, which is necessary where so extensive a plant is concerned.

Last week I mentioned the arrangements for financing the Bwana M'Kubwa Copper Co. in Rhodesia. It is now rumored that a similar plan is being taken in hand to provide the Rhodesia Broken Hill with additional capital to start its new plant and to extend. The technical advisers to this company are still the Central Mining & Investment Corporation. It is clear from this and the activities of A. Chester Beatty that copper mining in Rhodesia will undergo great development in the near future. It is believed by some that the demand for the metal exceeds the present supply, and that even if the production should increase to any substantial extent, a reduced price would have the effect of stimulating consumption.

The Hampton Celebration (Western Australia), which created a furore some few years ago owing to the discovery of rich ore at shallow depth, has come to the end of its resources and is being reconstructed. Values varied, but generally improved with depth; development was not financed out of earnings in the early stages. The mine is now opened up to the 400 level, and at that point the disclosures are said to be satisfactory. It is believed that when the main shaft is sunk to the 500 and 600 levels a further improvement will be shown. The 400 level is, however, driven on for only 69 ft., the average of this footage being 45s. 8d. per ton over a width of 57 in. In the South Drive from the crosscut, the average was 39s. 2d. over a width of 54 in.

For some months cable dispatches have been received on this side from South Africa to the effect that fairly extensive deposits of platinum have been found in the Lydenburg district of the Transvaal. Little that is official and satisfactory, however, has recently been published, but the shares of one or two companies, notably Transvaal Estates & Development and Transvaal Consolidated Lands—both of which own numerous farms in the Lydenburg district—have advanced sharply. A rumor in connection with one company states that if the discovery is not on that company's property it must be on an adjoining one, the suggestion being for speculative purposes that the particular company must have a continuation of the platinum deposit. It is thought possible in some quarters that one company has the vein in its area, and the other the alluvial.

The Francois Cementation Co. has come to grief, and is proposing to write down its 500,000 ordinary shares of £1 each to shares of 1s. each. There is plenty of work for the process, but complaints have been made of the cost.

Miami Copper Co. Will Spend $800,000 Improving Mill

THE Miami Copper Co., operating at Miami, Ariz., has decided to enlarge its crushing plant, mill ore bins, and pumping plant sufficiently to make possible production and treatment of 10,000 tons of ore daily. Present daily production is about 6,800 tons. Production on the larger scale will enable the company to mine profitably large tonnages of ore running about 1 per cent in copper which have heretofore been untouched. This ore has previously been delimited by diamond drilling and churn drilling and is now being developed by drifts and crosscuts. Work on the alterations to the mill and plant will begin about the first of the year and will entail the expenditure of about $800,000.

United Comstock Property Brought "Less Than a Million Dollars"

The purchase of the United Comstock property at Virginia City, Nev., by the Comstock Merger Mines Co., which had not been actually closed when our last issue went to press, went through without a hitch. Officials of the United Comstock say that the consideration was "under one million dollars," whereas officials on the buying side decline to make any statement. The Comstock Merger Co. is owned jointly by the Gold Fields American Development Co., which is the American subsidiary of the Consolidated Gold Fields of South Africa, and the National Mining Corporation, Ltd., both prominent London houses.

By the terms of the sale the entire assets of the United Comstock are turned over to the Merger company. A subsidiary to be known as the Comstock Milling Co. may be organized to operate the reduction plant. It is now treating about 1,400 tons of ore per day from the United Comstock mine, giving a good extraction, and making a small operating profit. The new owners will extend the main transportation tunnel in the newly acquired ground, northward to tap their original holdings. It is understood that nearly 2,000,000 tons of profitable ore has been developed in the old Savage, Gould & Curry, Chollar-Potosi, and Hale & Norcross properties. Ore from these mines will be sent to the United Comstock mill as soon as transportation is provided.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Ontario Government Will Pay 1c. Bounty on Iron Ore

Hope That Mining Will Result — No Production in Province at Present —Power Deal Pending

Toronto, Nov. 24—G. Howard Ferguson, Premier of the Province of Ontario, has announced that the Ontario Government will pay a bonus of 1c. per unit of metallic iron in ores which have been beneficiated or concentrated in Ontario and sold to any blast furnace or steel works. At the last session of the Ontario Legisiature an act was passed entitled "The Iron Ore Bounty Act of 1924," under which the government agreed to pay a bonus of ½c. per unit. This act followed the recommendation of the Ontario Iron Ore Committee appointed by the government, which made a thorough study of the situation and was passed with the understanding that the Dominion Government would be approached to pay the additional ½c. However, the Dominion Government refused to do this and the Ontario Government has now announced that it will pay the full bounty of 1c. itself. This will probably mean a good deal to iron mining in the province, because the bounty will, in some cases at least, represent the difference between profit and loss. At the present time no iron ore is mined in the province.

It is expected that an announcement will be made within the next few days regarding the consummation of the big power deal in northern Ontario. Since the negotiations were originally opened by the Insull interests in Chicago, several changes have taken place and it is understood that the Insulls are not now connected with the deal. E. R. Wood & Co., a financial house of Toronto, has an option on the Northern Canada Power Co., which supplies the Porcupine mines, and it is believed that the big factor in the deal will be Nesbitt, Thomson & Co., Ltd., a Canadian bond house specializing in the sale of hydro-electric securities. The companies to be taken in on the deal are the Northern Canada Power, Great Northern Power and Northern Ontario Light & Power which supplies the Cobalt and Kirkland districts. An essential factor is of course the Hollinger power development at Island Falls, but whether this will be taken over by the new company or whether it will be turned over to the Abitibi Pulp & Paper Co., is not yet known. In any event the Hollinger is expected to get rid of its power and to be assured a sufficient supply to meet all present and future requirements at a price considerably less than

is now being paid. It is reported that the new company will have a capitalization of $20,000,000 to $25,000,000.

At a meeting of the Night Hawk Peninsular Co., held in Pittsburgh, shareholders approved of the plan to refinance the mine. Authorization was given for the issue of $500,000 7 per cent cumulative preferred shares and $500,000 in 7 per cent bonds.

Melbourne Letter

By Peter B. Tait
Special Correspondent

Mararoa Gold Takes Option on New Properties

Will Prospect Neighbor of Gwalia Con. —Electrolytic Zinc Co. Buys Tasmanian Mine

Melbourne, Oct. 21 — The Mararoa Gold Mining Co., which had a successful career with its mine at Norseman, Western Australia, has been on the lookout for new properties during the last several years. A considerable sum has been spent on options and prospecting. Recently, the company acquired an option over the Emu group of mines 30 miles northeast of Cue, and about 10 miles from the railway. R. C. Wilson, assistant state mining engineer for Western Australia, has reported favorably on the property, estimating that above the 170 level there is 15,000 tons of ore averaging 50s. per ton. The mine is equipped with a battery. The company has also taken up leases in the Wiluna district in close proximity to the Gwalia Consolidated mines, and has entered into a contract for prospecting one of the leases by diamond drill.

The Electrolytic Zinc Co., which holds the Hercules-Mt. Read-Rosebery mines on the West Coast of Tasmania, has purchased the property formerly known as the North Tasmanian Copper Mines. The sampling of the workings has indicated that the ore has about the same zinc, lead, and silver contents as the adjoining Rosebery mine. The milling plant for the selective flotation of the complex ores from this group of mines is expected to be in operation this month. Investigations show that a good-grade silver lead product and a high-grade zinc product can be produced. The former will be shipped to Port Pirie for treatment and the latter will be roasted at Zeehan and shipped to the Risdon works.

The Antox Co., Costerfield, Victoria, has increased the output from its mines, and the production of antimony concentrates is 110 tons a month. The gold contents of the concentrates average 48 dwt. a ton and 62 per cent antimony. Another consignment of 30 tons of concentrates and 20 tons of residues is being shipped to the St. Helen's smelting works, England. The refined oxide from the company's smelters at the works is being sold for paint and enamel manufacture in Australia.

The Briseis Central Tin Mining Co. has been favorably reported on by P. B. Nye, Tasmanian government geologist. The property was originally known as the Ringarooma Valley mine. It was worked later by the Briseis Extended Co. between 1904-1910.

Butte Zinc Mines Shut Down by Fire at Anaconda

A FIRE in the zinc-concentrating department of the Anaconda Copper Mining Co.'s reduction works at Anaconda has made necessary the shutting down of all the zinc mines in Butte except the Elm Orlu mine of the Clark interests. The Black Rock mine, of the Butte & Superior Mining Co., the ore from which is shipped to Anaconda, as well as the Anselmo, Orphan Girl, Emma, and Nettie mines of the Anaconda company, will be down for about a week.

Although the zinc plant will be disabled for several months at least, units No. 7 and No. 8 of the copper plant will be changed over temporarily for the treatment of zinc ore. The loss to the building alone is estimated at $100,000 and that incurred by machinery and equipment is probably considerably in excess of this sum.

Burma Mines Produced 4,500 Tons Lead and 465,000 Oz. Silver in October

The Burma Corporation, Ltd., during the month of October, mined 22,876 tons of ore from its Bawdwin property in the Northern Shan States, Burma. A total of 21,880 tons of ore was milled producing 10,836 tons of lead concentrate; 10,597 tons of lead-bearing material was smelted in the blast furnaces, producing 4,267 tons of hard lead for treatment in the refinery. Refinery products were 4,500 tons of refined lead, and 465,000 oz. of refined silver. Of the silver production, 23,000 oz. was recovered from the treatment of copper matte. The experimental zinc plant produced 1,855 tons of zinc concentrates, assaying 10.57 oz. of silver, 8.58 per cent of lead, and 45.51 per cent of zinc.

In addition to the production above noted, 315 tons of copper matte was produced from the treatment of 1,297 tons of copper ore and accumulated smelter byproducts. Silver production for August was reported as 449,000 oz. This should have been 440,000 oz., of which 9,500 oz. was recovered from the treatment of copper matte.

Terlingua, Texas, Quicksilver Production Will Be Increased

It is expected that the quicksilver production of the Terlingua district, in Texas, will be largely increased as soon as the large furnace of E. A. Waldron, at his group of eight claims, is finished. Considerable development work has been done upon the claims, the workings having reached a depth of 150 ft., uncovering a large body of rich cinnabar ore. The quicksilver mine of the Chisos Mining Co. near here continues to be a large producer of the liquid metal. It is stated that several of the older mines which were closed down a few years ago are to be reopened.

Johannesburg Letter

By John Watson
Special Correspondent

Official Visitors Inspect Phthisis Hospital and Gold Refinery

See £250,000 Worth of Pure Bullion— Transvaal Platinum Has Good Assays—Starts Mining

Johannesburg, Oct. 20—On Oct. 13, the Empire Parliamentary delegates visited the Miners' Phthisis Bureau and Institute of Medical Research, where the party was conducted by Sir Spencer Lister, who gave explanations of the different classes of scientific work in progress. By injecting the serum, from a horse's blood, into the spine the death rate among whites and natives in South Africa has been greatly decreased.

The party were next taken to Germiston, by motor cars, welcomed by the mayor of Germiston, and after refreshments, were shown over the Rand Gold Refinery. The manager, L. Chalmers, acted as host, and the refining, analyzing, and assaying processes were described by L. C. Reedy and F. V. Ramsden. Refined gold bullion, in bright yellow bars, to the value of a quarter of a million sterling, was shown on a table for comparison with the rough product received from the gold mines. The process of separating the silver from the gold by acid treatment was demonstrated.

Transvaal Platinum, Ltd., has recently published the report for the quarter ended Sept. 30. The footage driven in the three months was: Welgevonden, 503; Rietfontein, 864; total, 1,367 ft. In addition, 4,292 ft. of trenching was completed in prospecting outside farms. On Rietfontein, at the 50 level, all winzes have been connected up, and there is continuous driving on the strike of the south lode for a distance of 790 ft. Eighty-one feet have been driven on the 100 level without encountering the very high values obtained on the 50 level. Recently the values have improved and sections assaying up to 12 dwt. over 24 in. have been returned.

On Welgevonden, at the 100 level, after driving 29 ft., underground water was encountered. A suitable pump has been installed and development will soon be resumed. Systematic sampling of the lode, westward on Welgevonden, has proved the presence of rich ore for a distance of 560 ft. west of No. 3 winze. At 450 ft. west of the latter, a strike was made, with assays giving 64.8, 489.5, 70.0 dwt. over a width of 24 in. A start has been made to work the ore out, from the outcrop downwards at selected spots, and two paddocks, or quarries, are now well established. High values have come from the ore broken in these two places. At the No. 3 paddock, there have been assays of 42.5, 79.9, 169.5, 131.0, 222.0, and one of 2,750.0 dwt. per ton. At No. 6 paddock grab samples have given 86.5, 164.5, and the highest yet recorded of 3,334.5 dwt. The majority of the assays vary between 1 and 10 dwt., with traces in many cases.

The Elkoro mill. A small plant that is operating steadily and profitably

Increased Earnings from Elkoro Mine, at Jarbidge, Nev.

The Elkoro Mines Co., operating a gold property at Jarbidge, in northern Elko County, increased production and profits during the quarter ending Oct. 31. The mine produced 13,508 tons of ore, average value per ton $11.48, gross value $155,134. Net profit for the quarter was $73,112 compared with $37,615 for the second quarter of the year.

The company is a subsidiary of the Yukon Gold Co. In 1923 the net profit was $113,959 realized from the treatment of 40,244 tons of $9.11 ore. The cost of mining and milling was $5.64 per ton, which is a good record for a plant of small tonnage.

News from Washington

By PAUL WOOTON
Special Correspondent

Michigan Copper Interests Play Lone Hand in Tariff Proposal

Interests in Foreign Mines and Regard for Refining Business Will Deter Most Producers from Supporting Duty

ON THE EVE of the opening of the session of Congress at which a duty on copper will be agitated, it is apparent that the effort will have no support other than that of the Calumet & Hecla Consolidated Mining Co. and the Paine interests. With them, it is true, is allied Gordon Campbell, of the Calumet & Arizona company, but in that relation he is influenced by his Michigan holdings rather than connection with operations in Arizona.

It is apparent that all other large copper producing interests will testify against the proposal, if they are called before congressional committees. The Kennecott Copper Co. is expected to oppose it, because of its ownership of the Braden Copper Co. In like manner, the Anaconda company would be influenced by its ownership of the Chile Copper Co. The American Metal Co. is expected to oppose the duty because of its interest in the Cerro de Pasco Copper Corporation and the Nichols Copper Co., the latter concern being engaged in smelting Katanga copper. The Phelps Dodge Corporation is engaged in large copper operations in the Pilares district of Sonora through the Moctezuma Copper Co.

While our exports of copper now are on a pre-war basis, perhaps the greatest argument being brought forward against a duty on copper imports is the effect it would have on the very important and growing smelting industry. Three-fourths of the world's copper now is being refined in this country. Our supremacy in this industry is indicated strikingly by the fact that we are refining half of the copper produced in Spain.

American enterprise and money has built up a very profitable activity which is a large employer of labor and buys enormous amounts of machinery and materials. The character of smelting operations is such that the business frequently turns on comparatively minor matters. We lost our tin smelting industry to Europe. It is regarded as entirely possible that the red tape and annoyance of securing the "drawback" and the one per cent charge might be just enough to encourage the British or the French or the Germans to attempt to win a portion of this lucrative business. We also enjoy certain incidental advantages through the by-products resulting from the refining operations. Any amount of antimony, for instance, that is derived from copper ores relieves us to that extent from drawing on distant sources of supply, such as China and Bolivia.

Jarbidge, Nev.

At the right is the Elkoro mill and cyanide plant. The steep profile of the hill shows the excellent millsite

Ray Hercules Copper Property Sold at Sheriff's Sale

On Nov. 18, the property of the Ray Hercules Copper Co., adjoining the Ray Consolidated Copper Co., at Ray, Ariz., was "knocked down" at a sheriff's sale, held at Forence, Ariz., to C. E. Scott, a Phoenix attorney, representing the Chatham & Phenix National Bank of New York City. A judgment of $1,139,810.46 was recently granted against the property by the Superior Court of Pinal County, and the purchase price amounted to $450,000, leaving a deficiency of $689,810.46 in the amount of the judgment against the property.

The purchasers, who represent creditors to whom the judgment was awarded, state that the taxes assessed against the property, two weeks before the mine suspended operations two years ago, amounted to $120,000 and that this claim was settled by a cash payment of $83,000, arranged through the country board of supervisors acting as a board of equalization.

Betts Lease Shipments Good

Two cars of ore, about 80 tons in all, were shipped from the Betts lease ground last month. This was the first ore from the Royston district in Nevada for some time, and was the best grade ore ever shipped from the property. One car was comparatively low grade, returning a gross of $2,176 or slightly more than $50 per ton. The high-grade car returned a gross of $17,880 or over $400 per ton.

People You Should Know About

Dr. Marie Farnsworth has the distinction of being the only woman member of the technical staff of the Bureau of Mines. She is employed as a chemist at the Bureau's non-metals experiment station at New Brunswick, N. J. Miss Farnsworth is engaged on research work dealing largely with gypsum and anhydrite. She comes from Holden, Mo., but took her doctor's degree and received most of her education at the University of Chicago, where she was graduated in 1918.

Dr. Marie Farnsworth

Harlowe Hardinge, of New York, is in California.

E. T. McCarthy, recently at Phoenix, Ariz., has returned to London.

Carl N. Anderson, consulting mining engineer, is in New York from Portland, Ore.

W. L. Dudley, who is developing a silica deposit near Kamloops, B. C., has been spending a week in New York.

C. B. Lakenan, general manager for the Nevada Consolidated Copper Co. at Ely, Nev., has returned to Ely from San Francisco.

Walter Douglas, president of the Phelps Dodge Corporation, has been visiting the company's properties in Bisbee and Nacozari.

W. S. Larsh, superintendent of mines for the Nevada Consolidated Copper Co. at Ely, Nev., has returned to Ely from a trip to San Francisco and other coast points.

Charles Spearman, consulting engineer, in an address to the Montreal Electrical Club on Nov. 18, speaking of the richness of the northwestern Quebec gold fields, stated that in one 200-acre area $20,000,000 worth of gold had been found.

Colonel William Boyce Thompson, president of the Magma Copper Co., attended a meeting of Southern Pacific officials in El Paso recently, relative to the merging of the Magma railroad with Southern Pacific Interests.

Dr. F. L. Ransome, formerly of the U. S. Geological Survey and now professor of geology at the University of Arizona, recently accompanied his student body to Ray, to visit the mines and study the surrounding country.

Thomas Baker, an engineer in the employ of the Gold Fields American Development Co. in its Mexican operations, has arrived in Virginia City, Nev., in the interest of the reported consolidation of the Comstock Merger with the United Comstock.

James F. McCarthy, of Wallace, Idaho, president and general manager of the Hecla Mining Co., after attending the meeting of the directors of the company, in Milwaukee, on Nov. 12, proceeded to Washington, D. C., and will visit New York and other eastern cities before returning to Wallace.

Theodore Pilger, of Butte, Mont., has been appointed Trade Commissioner to Berlin, Germany, by Dr. Julius Klein, Director of the Bureau of Foreign and Domestic Commerce. Mr. Pilger is a graduate of the Montana School of Mines and has had an extensive and varied career as a mining and mechanical engineer, sales engineer and geologist. As a member of the Commercial Attache's staff at Berlin, he will devote his attention particularly to the metallurgical situation, and will follow closely the developments in the German machinery, agricultural implements, and electrical apparatus industries and allied trades. Mr. Pilger sailed for his new post on Nov. 12.

Theodore Pilger

Stewart Campbell, mine inspector for the State of Idaho, spent two weeks in the Coeur d'Alene district in November, which completed his field work for the year. Upon his return to Boise he will devote the remainder of the year to preparing his annual report, which should be ready for distribution in February. Mr. Campbell has just been re-elected for another term of two years.

T. C. Baker, assistant manager of the Mexican Corporation, with headquarters at Fresnillo, Zacatecas, Mexico, owing to the recent acquisition of the mining properties and mill of the United Comstock Mines Co. by the Comstock Merger Mines Co., a corporation controlled by British interests, will leave immediately for Virginia City, to fill the position of manager of the new unit, the Comstock Merger Mines Co., and organize the future work of the company.

Alfred Hulse Brooks

Alfred Hulse Brooks died suddenly on Saturday, Nov. 22, in Washington, D. C. He was a distinguished geologist, geographer, and Alaskan explorer. From 1894 till the time of his death he was a member of the U. S. Geological Survey, and since 1899 he had been chief of the important Alaskan division. As such he became probably the foremost authority on Alaska in all its aspects. He served as vice-chairman on the Alaskan Railroad Commission, appointed by President Taft. When the Great War came, he entered an officers' training camp in spite of being over the regulation age and far from sound physically; and was afterward appointed major, and later lieutenant colonel of engineers and assigned to the chief engineers' staff in France, in charge of the study of the application of geological science to warfare, where he remained throughout the war. Since those strenuous days he had plainly been physically broken, and it was a matter of surprise, mixed with admiration for his spirit, when he took the field in Alaska last season, a trip from which he returned apparently improved.

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Alfred Hulse Brooks

Brooks was a fine type of the public servant, having given his life entirely to public service without grudging and with zest, and his accomplishments in this work are far too many and of too great importance to be listed shortly. He received the gold medals of the American Geographical Society, and also of the Geographical Society of Paris, France, for his contributions to the knowledge of geography; and many other well-merited honors. He was able; full of enthusiasm and cheerfulness; he had a host of friends who loved and respected him.

Brooks' career was in accordance with his family tradition, since his father was a distinguished geologist, Major Thomas Benton Brooks, who also served his country in the Civil War.

Alfred Brooks married in 1903 Mabel Whitman Baker, of Washington. Mrs. Brooks and two children, Mary and Thomas Benton, survive him.

Brooks was a graduate of Harvard in 1894; he also studied in Germany and France, and received from Colgate University the honorary degree of Doctor of Science. He was born in Ann Arbor, Mich., in 1871. J. E. SPURR.

Recent Technical Publications

Reviews, Abstracts, and References

Stories of Scientific Aberrations

Foibles and Fallacies of Science. By D. W. Hering. D. Van Nostrand Co., New York. Price $2.50.

This book traces the history of some of the vagaries of scientific thought, covering such subjects as astrology, the transmutation of metals, perpetual motion, divination, and radiation, with chapters on almanacs, the overturning of scientific hypotheses, geographic mania, hoaxes, prophesies, charlatanism, and various chimerical ideas. In other words, the author discusses the paths which have been adopted by scientific men which have led nowhere —ideas which have been proved untenable. To be sure, some of the fields covered have been fertile ones for frauds, but most of the developments outlined in this book seem to have enlisted the attention of honest, though deluded, men.

We did not find the book so interesting as its title, most of it being, to us, a rather dry historical record.

E. H. R.

Commerce Yearbook, 1923. Published by the U. S. Department of Commerce, Washington, D. C. Price, 85c. from the Superintendent of Documents, Washington, D. C.

The usual data covering production, consumption, domestic and foreign trade, with much explanatory text, occupies the 700 pages of this book. About thirty pages are devoted to the metals.

The American Society of Heating and Ventilating Engineers Guide, 1924-25. Published by the A. S. H. & V. E., 29 West 39th St., New York City. Price $3.

This is the third annual edition of this handbook of practical design data on heating and ventilation. The four sections include technical design data, manufacturers' catalog data, an index to modern equipment, and the society's membership roll. A chapter on oil fuel for industrial and domestic heating is of especial interest. Other chapters cover heat losses from buildings; heating by radiation; pipe sizes for steam heating; boilers; pumps; hot-water heating; warm-air heating; gas heating; automatic heat control; insulation; ventilation; air washers and filters; air ducts; how to use the pitot tube; exhaust and collecting systems; and refrigeration.

Manchuria, Land of Opportunities. Compiled and published by Thomas F. Logan, Inc., New York, for the South Manchuria Railway Co. Obtainable from Kinuji Kobayashi, American representative S. M. Ry. Co., 111 Broadway, New York.

This is the second revised edition of an attractive illustrated cloth-bound book first published in 1922, describing the resources of Manchuria and the opportunities for overseas trade and the facilities for travel. The country contains deposits of coal, iron, salt, soda, and magnesite, which have been more or less developed; and also known occurrences of oil shale, talc, mica, asbestos, feldspar, fluorspar, sulphur, niter, and silica.

British Guiana. Published by The Committee of Correspondence and Exhibitions, Royal Agricultural and Commercial Society, British Guiana.

This is a handbook prepared for the British Empire Exhibition just closed at Wembley. It is an attractive guide and reference book for all those interested in this country, with numerous good photographs and maps. Several pages are devoted to the mining industries, the principal products being gold, diamonds, and bauxite.

Transactions of the American Institute of Chemical Engineers. Vol. XV, Part I, 1923. D. Van Nostrand Co., New York. Price, $6.

Some of our readers may be interested in a few of the papers in this volume, such as: "Some Factors Influencing the Design of Absorption Apparatus," "A Theory of Gas Absorption in Countercurrent Apparatus," "The Refining and Recovery of Petroleum Products with Silica Gel," "Some Notes on the Action of Fuller's Earth on Vegetable Oils," and several papers on activated carbon.

Annual Statistical Report of the American Iron and Steel Institute for 1923. Published by the American Iron and Steel Institute, 40 Rector St., New York City.

Production and consumption data for iron and steel are thoroughly covered in this report.

Lake Superior Mining Institute—Vol. XXIII of the *Proceedings* of the Lake Superior Mining Institute (Ishpeming, Mich.) has recently been issued. Among the papers published in this volume are: "Fire Prevention and Fire Fighting in Metal Mines," pp. 13, by Lucien Eaton and William Conibear; "Recent Developments in the Geology of the Gogebic Range," pp. 9, by W. O. Hotchkiss; "Surface Equipment for Iron Mines," pp. 7, by E. S. Bonnell; "Slushing Practice in the Mines of the Oliver Iron Mining Co.," pp. 10, by Ford E. Boyd; "The Wear and Care of Wire Rope," pp. 7, by William Constable; "A Brief History of the Cuyuna Range," pp. 6, by J. Wilbur Van Evera; "Development of the Use of Cuyuna Range Manganiferous Iron Ores," pp. 6, by L. E. Ives; "Guniting in the Athens Mine Shaft at Negaunee, Mich.," pp. 8, by C. W. Nicholson; and "Mesabi Iron Company's Reduction Plant," pp. 6, by W. G. Swart.

Geology—Bulletin 758 of the U. S. Geological Survey, Washington, D. C., pp. 273, obtainable on request, is a bibliography of North American Geology for 1921-1922, by John M. Nickles. This book supplements several similar volumes previously issued by the Survey.

Prevention of Blindness — The National Committee for the Prevention of Blindness, 130 East 22d St., New York City, has issued a 247-page book on "Eye Hazards in Industrial Occupations," by Louis Resnick and Lewis H. Carris. The book is the result of extensive study and will prove of value to all safety engineers. The price is $1.50 bound in cardboard or $2.50 bound in fabrikoid.

Mineral Resources — The following separates of "Mineral Resources in 1923" have recently been issued by the U. S. Geological Survey, Washington, D. C., from which they may be obtained free: "Salt, Bromine, and Calcium Chloride," pp. 10, by K. W. Cottrell; "Asphalt and Related Bitumens," pp. 8, by K. W. Cottrell; "Lead and Zinc Pigments and Salts," pp. 10, by C. E. Siebenthal and A. Stoll; "Lead," (smelter report), pp. 16, by C. E. Siebenthal and A. Stoll; "Sand and Gravel," pp. 11, by A. T. Coons; "Manganese and Manganiferous Ores," pp. 14, by Helena M. Meyer; "Mineral Waters," pp. 16, by W. D. Collins; "Talc and Soapstone," pp. 5, by B. H. Stoddard; and "Arsenic," pp. 22, by V. C. Heikes and G. F. Loughlin.

Mineral Resources of Washington— Bulletin No. 30 of the Division of Geology of the State of Washington, Olympia, Wash., is a 224-page bulletin on the "Mineral Resources of Washington" with statistics for 1922, by Solon Shedd. It describes all the active mining operations of the state and discusses the economic situation of all of the more important metals and nonmetallic minerals.

Algerian Phosphate — The *Annales des Mines*, Vol. 6, No. 9 (1924) (H. Dunod, 92, Rue Bonaparte (VI), Paris, France; price 7.50 fr.) contains an 86-page article, to be continued, on "Les Gisements Algériens de Phosphate de Chaux."

Cobalt Silver—The Ontario Department of Mines has published a pretentious monograph, elaborately illustrated with maps, covering the silver industry of northern Ontario. The geology and mine workings of the Cobalt and South Lorrain areas are described in a 275-page paper by Cyril W. Knight and a discussion of the milling and metallurgical practice by Fraser D. Reid, James J. Denny, and R. H. Hutchison covers 80 pages. The foreword to the book is interesting: "'The ore is undoubtedly very rich, containing values in nickel, cobalt, silver, and arsenic, and a comparatively small vein could be worked at a handsome profit.' —Willet G. Miller in the *Engineering and Mining Journal*, December 10, 1903." Those were prophetic words. The book contains a large amount of material of interest to all mining men and silver metallurgists and is a credit to its authors and to the Ontario Department of Mines, from which it may be obtained free of charge. Requests should be addressed to the department at Toronto, the book being Vol. XXXI, Part II, of the 31st annual report.

Spanish Mineral Industry — "Estadística Minera de España" formada y publicada por el Consejo de Mineria, año 1922," has been received. This is a book of 600 pages and is obtainable from the Consejo de Mineria, Madrid, Spain.

Patents

Nitrate Recovery—No. 1,513,014. Oct. 28, 1924. E. A. Cappelen Smith, New York, assignor to Guggenheim Bros., New York. A method of recovering sodium nitrates from caliche comprising leaching the caliche with mother liquor at atmospheric or slightly higher temperatures, thus obtaining practically a saturated solution. This is cooled by refrigeration, regulating the rate to avoid any substantial precipitation of sulphate with the nitrate, and the mother liquor returned to the leaching step of the process.

Arsenic—No. 1,512,733. Oct. 21, 1924. E. W. Westcott, Niagara Falls, N. Y., assignor to Metallurgical Development Corporation, Boston. Arsenious chloride, produced from the chlorination of arsenic ores, is mixed with a small amount of water, the solid arsenious oxide produced by hydrolysis removed, and the mother liquor chlorinated to produce arsenic acid, which is neutralized to produce arsenates.

No. 1,512,734. Oct. 21, 1924. Same applicant and assignment as No. 1,512,733. An arsenic ore is chloridized with chlorine at a high temperature, the resultant gases are cooled to a temperature near but above the liquefying point of arsenious chloride, the ferric chloride and dust removed, the gases then cooled further to liquefy the arsenious chloride, which is heated with arsenious oxide to break up sulphur chloride, and the arsenious chloride redistilled.

Petroleum—No. 1,513,228. Oct. 28, 1924. F. E. Crotto, Tulsa, Okla. An expansion well washer.

No. 1,513,627. Oct. 28, 1924. W. F. Reschke, Wichita, Kan. A connecting rod for oil-well walking beams.

No. 1,514,062. Nov. 4, 1924. R. M. McLain, Fort Worth, Tex., assignor of one-half to E. A. Reilly, Fort Worth. A means for incasing wells.

No. 1,514,415. Nov. 4, 1924. O. G. Arnot, Bakersfield, Calif. A rotary drilling bit.

No. 1,514,585. Nov. 4, 1924. C. R. Edwards, Houston, Tex. A testing device for oil wells.

No. 1,514,978. Nov. 11, 1924. G. H. McLean, Tampico, Mexico. A well stopper.

No. 1,515,066. Nov. 11, 1924. Clarence Ochs, Long Beach, Calif. A pressure gun for fishing tools.

Zinc Metallurgy—No. 1,513,280. Oct. 28, 1924. W. A. Schmidt, Los Angeles, assignor to International Precipitation Co., Los Angeles. Zinc-containing material is heated to melt and volatilize the zinc, the vapor being swept out of the chamber by an inert gas and the zinc condensed in finely divided form. The residual gas is returned to the chamber in a cyclic operation.

Mine Skip—No. 1,513,296. Oct. 28, 1924. E. C. Thorne, Turffontein, Transvaal, South Africa. A design for mine skip with automatic braking action against the rail when the vertically tilting wheeled axle is tilted to a certain position.

Electrolysis—No. 1,513,119. Oct. 28, 1924. C. P. Madsen, New York, assignor to Madsenell Corporation, New York. A method of electro-depositing metals by which the cathode is rotated, allowing a portion to be exposed to the atmosphere so as to permit the hydrogen in the deposited metal to be dissipated.

Metallurgy of Vanadium—No. 1,513,200. Oct. 28, 1924. M. J. Udy, Niagara Falls, N. Y., assignor to Electro Metallurgical Co., New York City. Vanadium ore also containing other metals is mixed with an alkali, and a material capable of supplying sulphur to combine with a metal to be separated from the vanadium, and the charge heated to fusion.

Lead Refining—No. 1,513,307. Oct. 28, 1924. E. S. Berglund, Djursholm, Sweden, assignor to Trollhättans Elektrothermiska Aktiebolag, Stockholm, Sweden. A method of refining impure lead consisting in heating the lead by electric heat so as to volatilize contained impurities, condensing these impurities, oxidizing the non-volatile impurities, withdrawing the scum thus formed, and tapping the refined lead.

Sintering—No. 1,513,466. Oct. 28, 1924. R. L. Lloyd, New York City, assignor to Dwight & Lloyd Sintering Co. Inc., New York. Variation in design of the Dwight & Lloyd sintering machine.

Smelting Complex Ores—No. 1,513,775. Nov. 4, 1924. W. G. Waring, Webb City, Mo. Complex refractory ores containing volatile and non-volatile metals and sulphur are smelted in a blast furnace with a low charge of ore, flux, and fuel, at a temperature to form and fuse highly siliceous slags. Hot blast is supplied in sufficient amount to form matte and to drive off the volatile constituents. The vapors passing away from the charge are burned by the introduction of hot air at a point above the top of the charge, and the oxidized fume is collected.

Cobalt-silicon Alloy—No. 1,513,806. Nov. 4, 1924. C. G. Fink, Yonkers, N. Y., assignor to Chile Exploration Co., New York City. An alloy containing cobalt in predominant amount and between 10 and 20 per cent of silicon.

Flotation Process—No. 1,513,812. Nov. 4, 1924. E. T. Henderson, Broken Hill, New South Wales, Australia. Ground oxidized dry sulphide ores are heated to a temperature of about 700 deg. C. in a chamber containing no free oxygen and no agent that will reduce the minerals to metal. The ore is then cooled without coming into contact with oxygen, and subjected to the flotation process.

Crusher—No. 1,513,855. Nov. 4, 1924. Paul Phelps, Louisville, Ky., assignor to Vogt Bros. Manufacturing Co., Louisville. A type of jaw crusher.

No. 1,514,224. Nov. 4, 1924. R. C. Newhouse, Wauwatosa, Wis., assignor to Allis-Chalmers Manufacturing Co., Milwaukee, Wis. Design for a gyratory crusher.

Mineral Washer—No. 1,514,807. Nov. 11, 1924. R. M. Tweedy, Spokane, Wash. A form of rotary washer with a trough and receiving tank.

Drill Bit—No. 1,515,434. Nov. 11, 1924. G. H. Gilman, Claremont, N. H., assignor to Sullivan Machinery Co., Chicago. Design for a drill bit.

Societies, Addresses and Reports

Mathewson to Address M.M.S.A.

Dr. E. P. Mathewson, past president of the A.I.M.E., will give an illustrated talk at the meeting of the New York Section of the Mining and Metallurgical Society of America on Dec. 3 at the Harvard Club, New York City. His subject will be "A Visit to Rio Tinto."

Research Association Elects

At the fourth annual meeting of the Copper & Brass Research Association, the following men were elected as directors for the coming year, the first nine comprising the executive committee: R. L. Agassiz, president, Calumet & Hecla Consolidated Copper Co.; Edward H. Binns, president, C. G. Hussey & Co.; Stephen Birch, president, Kennecott Copper Corporation; F. S. Chase, president, Chase Companies, Inc.; John A. Coe, president, American Brass Co.; Walter Douglas, president, Phelps Dodge Corporation; Charles Hayden, vice-president Chino, Nevada Consolidated, Ray Consolidated, and Utah copper companies; C. F. Kelley, president, Anaconda Copper Mining Co.; H. J. Rowland, secretary and sales manager, Rome Brass & Copper Co.; J. W. Allen, treasurer, Greene Cananea and Inspiration copper companies; Henry F. Bassett, president, Taunton-New Bedford Copper Co.; H. C. Bellinger, vice-president, Chile Exploration Co.; J. Parke Channing, vice-president Miami Copper Co.; Joseph Clendenin, director Braden Copper Co.; Carl F. Dietz, president, Bridgeport Brass Co.; B. Goldsmith, president, National Brass & Copper Co.; E. O. Goss, president, Scovill Mfg. Co.; U. T. Hungerford, chairman, U. T. Hungerford Brass & Copper Co.; C. V. Jenkins, treasurer Chino Copper Co. and Utah Copper Co.; William Loeb, vice-president, American Smelting & Refining Co.; H. B. Paull, auditor, Calument & Arizona, and New Cornelia copper companies; A. B. Seelig, manager, Michigan Copper & Brass Co.

The following officers were elected: R. L. Agassiz, president; C. F. Kelley, F. S. Chase, Walter Douglas, H. J. Rowland, and U. T. Hungerford, vice-presidents; Stephen Birch, treasurer; George A. Sloan, secretary; and William A. Willis, manager.

Mr. Agassiz stated that the domestic industries showing the largest increase in uses of copper, brass and bronze were the electrical and building fields. The former consumed about 25 per cent more metal than in 1923, while there was an approximate increase of 12 per cent used in building construction.

In the building field, he said, the use of brass pipe had shown a very large gain over that of any previous year. To date there had been more than a 30 per cent increase over the first ten months of 1923 and this ratio would be maintained during remainder of the year. There also had been a large increase in the use of copper for leaders, gutters and downspouts, copper roofing, and in the use of brass and bronze hardware fixtures.

New Machinery and Inventions

A New Line of Compressors Introduced

Multi-stage centrifugal compressors, designed to supplement the line of single-stage machines recently developed, have been introduced by the General Electric Co. These compressors have been especially developed for furnishing various volumes at higher pressures than ordinarily obtained with single-stage machines. They will find their greatest applications in blowing blast furnaces, Bessemer converters, gas boosters, gas exhausters, in pneumatic material handling systems, in the agitation of liquids and in other similar applications.

The principal line of these compresors covers water-cooled machines designed to deliver volumes of from 3,000 to 60,000 cu. ft. per minute, at pressures up to 30 lb. or more. The line will also include two types of miniature, self-cooled machines designed to deliver volumes of from 250 to 1,400 cu. ft. per minute at pressures of from 2 to 6 lb. All types of these compressors are to be equipped with either motor or turbine drive.

Among the advantages claimed for the new compressors are higher efficiencies, simpler and stronger construction and minimizing of mechanical difficulties. A larger cooling capacity is expected to bring about greater efficiency, the conversion passages having been improved and the interstage passages simplified. Each complete unit has four bearings with an automatically lubricated flexible coupling. These bearings are supported by the foundation or base under the machine. In addition to these changes, all the various governing devices for these machines have been improved, including constant volume governors, constant suction governor, constant pressure governors, etc.

This new line of compressors is the result of a great deal of research work, extending over a number of years. Work has been in progress and machines have been made singly for some time, but the full line has just recently been rounded out and announced on the market.

An Amperehour Meter for Motive-power Service

A new meter, recently placed on the market, is designed for use on electric automobiles, trucks, mine locomotives, industrial tractors, etc., where severe conditions of operation are likely to be encountered. This is the Sangamo type NT meter. Installed on the truck or locomotive, it indicates by means of a black hand the amount of battery discharge that has taken place. Thus the operator can always tell what remaining capacity is available before the battery should be put on charge. This guards the vehicle from being stalled in service.

When the vehicle is placed on charge the meter automatically gives the battery the proper overcharge and opens the charging circuit at the proper time, thus eliminating the need for attendance. The meter is adapted to the control of batteries requiring two-rate charging for which purpose contacts at the gassing and full points are usually supplied.

The meter operates on the mercury motor principle and is simple in construction. One set of permanent magnets furnishes both the driving and damping flux and eliminates the need of a separate damping disk. The only exposed moving parts are a short section of the spindle and a small counterweight. The possibility of bearing troubles is precluded through the mercury flotation of the moving element which relieves the lower bearing of all pressure and results in a slight upward pressure of only one tenth of an ounce on the upper bearing. Because of the cushioning effect of the mercury, the bearing pivots are practically immune from the effects of heavy shocks and vibration.

The armature box is of molded insulation, specially treated to retard the formation of dross. A non-spilling mercury chamber effectively precludes all possibility of the mercury leaking out regardless of the way in which the meter is handled.

The adjustment of the meter is very simple, being obtained by means of a single clamp slider which can be securely clamped in position, thus assuring permanence of calibration.

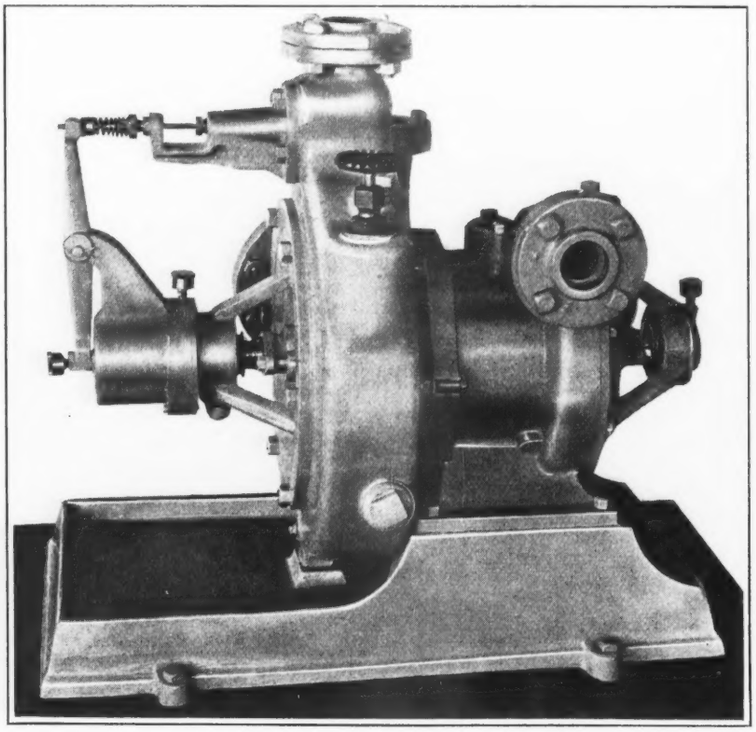
A variable resistor element with calibrated scale is provided to give the battery automatically the required excess of charge over discharge.

Return Line Heating Pump Has Interesting Features

Where a pump is required to maintain both a vacuum on the heating system and to return the hot water and condensation against pressure, a model produced by the Nash Engineering Co., South Norwalk, Conn., may be found useful. This pump combines a turbine integral with the casing and thus does away with the separate motor drive that is common with this type.

The unit consists of two independent turbine pumps built in one casing. One of these handles air and the other condensation. The air and condensation are separated in a receiver under vacuum before entering the unit. A saving in power is effected, it is claimed, from this arrangement, as the condensation, which is only one-eighth of the volume handled, is delivered alone against the discharge pressure. The air is delivered to the atmosphere.

The air end of the unit is a development of a vacuum pump in which the rotor revolves in an elliptical casing filled with water. The rotor in the unit is the only moving part. It carries the water with it in its turning, but owing to centrifugal force, it follows the casing. The water end of the machine is a centrifugal pump with an inclosed-type impeller, which gives high efficiency when handling hot water. When it is not handling condensation it unloads, and, it is claimed, requires very little increased power when delivering against low heads. The turbines are designed to operate at 75 lb. steam pressure, although the turbine casing is suitable for pressures up to 200 lb.



In this return-line heating pump the turbine is cast integral with the pump unit, thus doing away with the separate motor drive

The Market Report

Daily Prices of Metals

Nov.	Copper, N. Y. net refinery	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
20	13.45@13.65	54.00	54.50	8.70	8.40@8.80	6.80@6.825
21	13.50@13.75	54.00	54.50	8.75	8.40@8.80	6.80
22	13.60@13.75	54.00	54.50	8.80	8.40@8.75	6.80
24	13.75	53.75	54.25	8.80	8.40@8.75	6.825@6.875
25	13.75	53.75	54.25	8 80	8.40@8.75	6.875
26	13.75	54.00	54.50	8.80	8.40@8.75	6.90
Av.	13.683	53.917	54.417	8.775	8.583	6.840

*These prices correspond to the following quotations for copper delivered: Nov. 20th, 13.70@13.90c.; 21st, 13.75@14c.; 22d, 13.85@14c.; 24th to 26th, inc., 14c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Engineering and Mining Journal-Press* and a special representative of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce.

London

Nov.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
20	63¼	64¼	67¾	255½	258⅝	38¾	36¼	34 13/16	34⅝
21	63½	64⅜	67½	257½	260⅜	39⅛	36⅝	34 11/16	34⅝
24	63⅝	64⅜	67½	257⅜	260⅜	39¾	37⅛	34 13/16	34¾
25	63⅛	64⅝	67¾	255¼	258½	40	37⅛	34⅞	34¾
26	63¾	64¾	68¼	257	259¾	40½	37 7/16	35⅛	34 15/16

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Nov.	Sterling Exchange "Checks"	Silver		Gold London	Nov.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
20	4.62¼	68⅞	33⅜	89s 8d	24	4.62⅛	69⅛	33 7/16	89s10d
21	4.63¼	68⅝	33 3/16	89s 7d	25	4.62⅜	69¼	33 9/16	90s 0d
22	4 63⅜	68⅝	33¼	... ...	26	4.63⅛	69⅛	33 3/16	90s 0d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-quarter of a cent premium.

Metal Sales Good in Advancing Market

New York, Nov. 26, 1924—All of the non-ferrous metals were sold in satisfactory volume during the week ending today, and prices of copper, lead, and zinc registered moderate advances in both the London and New York markets. Tin and silver went through the week substantially unchanged. Platinum is quotably lower, at $117, though the official price of $118 could have been shaded slightly for some weeks. An excellent winter and spring business is expected by metal consumers.

Copper Back to 14c., Delivered

Between the 17th and 24th, copper slumped slightly from the 14c., delivered, level, but it has apparently regained the lost ground, for producers are a unit today in quoting the even figure for normal deliveries. Last Thursday found the copper market at its weakest, with producers who were holding at 14c. unable to do any business. Prompt deliveries sold as low as 13.70c., and for the three following days also, November and December copper was obtainable at from 13¾@13⅞c. It is possible that a little nearby copper may still be pressed on the market at cut prices, but it has been largely absorbed, the tonnage offered not being great. Consumers in the Middle West are being quoted 14⅛c. Most of the inquiry and sales have been for January and February delivery and brass mills took a good share of the business. Export sales were made yesterday around 13.90c., f.a.s., so there is no incentive to take less than 14c. delivered for domestic business.

United States mine production for October was 69,431 tons of contained copper, compared with 63,800 tons in September, so that the improved prices are seen to have stimulated production already.

Prompt Lead in Demand

The official contract price for lead, established by the American Smelting & Refining Co., continues at 8.65c., New York.

The market for lead improved somewhat this week, metal for December delivery being in especially good demand in the East. Cable manufacturers and others apparently found that they would need a little more lead than they had counted on, and several sales, of 50 to 100 tons principally, were booked for early delivery at from 9 to 9.15c., New York. Not a great deal of lead, especially of the desilverized variety, remains unsold for delivery this side of January, and holders are disposed to take nothing less than 9c. for it, regardless of the attitude of the principal interest. The continued strength abroad, the London price having gone above £40 today, is also having a sentimental effect on prices here, though at present levels the markets, of course, are entirely independent. Today's London quotation is equivalent to 8.37c. here.

In the Middle West, the market was not so active. One producer of chemical lead continues to sell at 8.40c. in limited quantities to regular customers, and another large producer has come down to 8.70@8.75c. St. Louis, from the 8.85c. level quoted last week.

Correction

The average London spot and forward lead quotations for the month of August should be £32.728 for spot and £32.038 for forward metal. This correction is necessary because of the fact that the London cable as decoded ignored a 1s. 3d. differential (1/16) for certain days. The correct quotations for the days indicated follow:

August	Spot	Three Months
7	32 3/16	31 3/16
13	(a)	32 1/16
14	(a)	32 1/16
19	(a)	32 1/16
20	32 1/16	32 3/16
21	33 1/16	32¼
22	32 1/16	(a)
29	32 1/16	32 1/16
Average, August	32.728	32.038

(a) Quotation originally published is correct.

Galvanizers Buying Zinc

Galvanizers took substantial quantities of zinc during the week, which, with a satisfactory export demand and advancing prices in London, brought the domestic price back up to 6.90c., East St. Louis, after a slight reaction of 10 points. Already, 7c. has been realized on export business. The inquiry has been for the first quarter for the most part, December requirements apparently being well provided for. High-grade continues unchanged, 8c. being obtained in the Middle West, and 8¼c. delivered in the East.

Tin Holds Steady

Tin prices held remarkably steady all week, with consumers anxious to buy when the slightest concession was offered. Some months ago they were indifferent to low prices. Government stocks in the Far East will decrease another 1,000 tons this month, leaving only about 1,300 tons unsold reserve, so apparently production must soon increase, with a possibility of higher prices. Some poor grades of 99 per cent tin have been offered recently at ⅝@¾c. under Straits.

Arrivals of tin to and including Nov. 24 total 5,065 long tons. Shipments may reach 7,500 long tons this month.

Foreign Monies Unchanged

Changes in the rates of foreign exchange during the week were unimportant. On Tuesday, Nov. 25, closing cable quotations were as follows: francs, 5.2625c.; lire, 4.335c.; and marks, 23.82c. Canadian dollars, ⅛ per cent discount.

Silver Slightly Lower

During the past week the London market has receded from 33½ to 33 ⅜d. under liberal sales. At the lower level there was a fair inquiry for India account, and sellers are inclined to hold back.

Mexican Dollars: Nov. 20th, 53c.; 21st, 52⅞c.; 22nd, 52⅞c.; 24th, 53⅜c.; 25th, 53½c.; 26th, 53¼c.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—99 per cent grade, 28c. per lb.; 98 per cent, 27c. London, £125 per long ton.

Antimony—Per lb.:
Chinese brands, 14⅜@14⅝c.
Cookson's "C" grade, 16¾@17c.
Chinese needle, lump, nominal, 10c.
Standard powdered needle, 200 mesh, 11½c.
White oxide, Chinese, 99 per cent Sb_2O_3, 13@14c.

Bismuth—$1.50@$1.55 per lb. London, 6s.

Cadmium—60c. per lb. London, 2s. 2d.@2s. 6d.

Iridium—$270@$275 per oz.

Iridium alloyed with platinum, $285 @$295.

Nickel—29@30c. per lb. for 99 per cent virgin metal. Electrolytic, 33c.; London, £160 per long ton.

Palladium—$79@$83 per oz. Crude, $60@$65.

Platinum:
Refined, Nov. 20, 21, 22, $118; 24, 25 and 26, $117 per oz.
Crude, $111.

Quicksilver—$68@$69 per 75-lb. flask. San Francisco wires $70; London £10⅝.

The prices of **Cobalt, Germanium Oxide, Magnesium, Molybdenum, Monel Metal, Osmiridium, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Tungsten,** and **Zirconium** are unchanged from the prices given in the Nov. 8 issue.

Metallic Ores

Chrome — $18.50@$24, depending upon grade and source. Nominal.

Manganese—39@41c. per long ton unit, seaport, c.i.f., for Caucasian and Brazilian ore, plus duty. Consumers well provided.

Molybdenum — 70@75c. per lb. of MoS_2 for 85 per cent concentrates. Nominal.

Tungsten Ore—Per unit, N. Y.:
Chinese wolframite, $8.75.
High-grade western scheelite, $9@ $9.25.

Iron Ore, Galena and Pyrite Radio Crystals, Tantalum, and Vanadium Ores are unchanged from Nov. 8 quotations.

Zinc Lower—Lead Unchanged

Joplin, Mo., Nov. 22, 1924

Zinc Blende

	Per Ton
High	$48.80
Premium, basis 60 per cent zinc	$46.00@$47.00
Prime Western, 60 per cent zinc	$45.00
Fines and slimes	$44.00@$42.00
Average settling price, all ores	$46.07

Lead

High	$123.30
Basis 80 per cent lead	$120.00
Average settling price, all ores	$121.37

Shipments for the week: Blende, 15,305; lead, 1,953 tons. Value, all ores the week, $942,170.

For blende with low to no lead content the price varied, $46, $46.50, and $47 being paid according to grading.

Lead continues stationary in price and demand is strong enough to take all ore offered for sale. Reserved stocks are practically nil.

Some sellers declined to accept the lower offerings on blende, though most of them sold rather than chance having ore left on their hands to be taxed at the end of the year. Purchases were 13,280 tons.

Platteville, Wis., Nov. 22, 1924

Zinc	Per Ton
Blende, basis 60 per cent zinc	$48.50
Lead	
Lead, basis 80 per cent lead	$122.00

Shipments for the week: Blende, 2,086 tons; lead, 211 tons. Shipments for the year: Blende, 28,251; lead, 1,346 tons. Shipments for the week to separating plants, 1,233 tons blende.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Beryl, Borax, Celestite, Chalk, China Clay, Corundum, Diatomaceous Earth, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Gypsum, Ilmenite, Iron Oxide, Lepidolite, Limestone, Magnesite, Manjak, Mica, Monazite, Ocher, Ozocerite, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystals, Rutile, Silica, Spodumene, Sulphur, Talc, Tripoli and **Zircon** are unchanged from Nov. 8 prices.

Mineral Products

Arsenious Oxide (white arsenic)— 6½@6¾c. per lb.

Copper Sulphate, Sodium Nitrate, Sodium Sulphate, and **Zinc Oxide** are unchanged from Nov. 8 prices.

Ferro-Alloys

Ferromanganese—Domestic, German, and English, $105 per gross ton, f.o.b. works, or duty paid at seaport.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferro-uranium and Ferrovanadium are unchanged from the prices given in the Nov. 8 issue.

Metal Products

Rolled Copper—Sheets, 21⅜c. base; wire, 16½c.

Lead Sheets—Full, 12c.; cut, 12½c.

Nickel Silver—Grade A sheets, 18 per cent nickel, 27¾c. per lb.

Yellow (Muntz) Metal—Sheets, 19½c. per lb.; rods, 16½c.

Zinc Sheets—10.75c. per lb.

Refractories

Bauxite Brick, Chrome Brick, Firebrick, Magnesite Brick, Magnesite Cement, Silica Brick, and **Zirkite are unchanged** from Nov. 8 prices.

Steel Advances

Pittsburgh, Nov. 25, 1924

Finished steel prices have been advancing. Bars, shapes, and plates are up $2 a ton in the week, with bars and shapes at 2.10c. and plates at 1.90c., all f.o.b. mill, Pittsburgh district. The American Sheet & Tin Plate Co. has opened order books for first quarter at unchanged prices for tin plate and blue annealed sheets, an advance of $2 a ton on black sheets and an advance of $3 a ton on galvanized and automobile sheets. Hot-rolled strips, cold-rolled strips, and railroad and small spikes are up $3 a ton. All wire products are up $2 a ton.

Pig Iron—Market firm at the recent advance, but not as active. Bessemer, $20.50@$21; basic, $19@$19.50; foundry, $19.50@$20.50, f.o.b. Valley furnaces.

Connellsville Coke — First-quarter furnace coke contracts closed now total over 100,000 tons a month, chiefly at $3.25, with a little at higher prices and with operators expecting to get up to $3.50 if the requirements for the quarter exceed those for this quarter as much as expected. Contracts carry a wage clause, which will probably function, as independents will probably be unable to hold their wages below the Frick scale. Spot furnace coke is $3.10 @$3.15, an advance of 10c., foundry remaining at $4@$4.50, with heating and smelter tending to advance, the market being $2.75@$3 according to grade.

The Suggested Revenue Act of 1925

By Robert Murray Haig
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WHEN PRESIDENT COOLIDGE signed the new Revenue Act on June 2, 1924, he gave his approval with the greatest reluctance and accompanied it with the declaration that he would do everything in his power to replace it with a new act at the earliest possible moment. The Washington dispatches in the days immediately following the election bring convincing assurances that the President intends to keep his promise. Apparently the embryo of a Revenue Act of 1925 is already incubating in the recesses of the Treasury.

I raise the question bluntly as to whether there should be a Revenue Act of 1925. It goes without saying that there should be an adjustment of the rates, if the present schedules prove to be more productive than the necessities of the Treasury require. But whether such an adjustment should be made the occasion for a general overhauling of the Revenue Act is a question which deserves serious thought. What are some of the considerations which should be borne in mind?

Instability in an income tax law is a grievous fault. The truth of this is inadequately appreciated by Congress. The wail of the harassed taxpayer arises occasionally in the wilderness, but the tinkering with the Revenue Act merrily continues. Four years ago Robert H. Montgomery wrote as follows in his standard book on "Income Tax Procedure":

"Federal income and profits taxation is merely 'one damn thing after another.' The average taxpayer is bewildered by a multitude of contradictory laws, regulations, and decisions. . . . What is needed is stability and confidence. Is it not possible for the taxpayer to pay and the government to receive money without a continuous, annoying, and expensive disturbance of the entire business and financial fabric of the country? If I were asked to write a tax plank for a political party I would have it promise to . . . make no further changes in the tax law (except in rates) for ten years. . . . In support of my suggestion for a ten years' truce, I make the statement that a few more radical changes in our tax laws would create a panic."

This was written in 1920. Since that date Congress has passed two complete new revenue acts, each radically different from its predecessor, and we are now threatened with another in 1925. No panic has occurred, it is true, but even the most temperate observer cannot fail to note many undesirable effects of the constant changes.

In the first place, it is no easy task which is imposed on the taxpayer when he is asked to master the details of these successive revenue acts. The changes are often fundamental in importance. They are complicated. To master them requires weeks of close study.

Again, it is often important that the taxpayer be informed before he enters into a transaction what his resulting liability will be. Under present conditions not only must he consult a specialist to determine what the existing law is, but he can have no assurance whatever that the policy incorporated in the existing act will continue. Worse than that, he must face the possibility of retroactive taxation. Not one of the revenue acts passed since 1913 has been signed by the President before the beginning of the taxable year to which it applied. The Revenue Act of 1918, which taxed income arising after Jan. 1, 1918, was finally approved Feb. 24, 1919! Moreover, the legislation is sometimes substantially retroactive in effect for a period extending long before the effective date of the act; witness the reorganization provisions of the 1924 act, of particular importance in the mining industry, which change radically the basis for measuring depreciation, depletion, gain, and loss in the case of reorganizations which were made as long as seven years ago. Under such conditions the taxpayer is constantly in the presence of an undetermined, contingent liability for federal taxes which must exert the effect of stifling enterprise and breeding uncertainty in business.

In the next place, every change made in the Revenue Act means a possible court decision or series of decisions before its meaning can be definitely established. The American rule of procedure is for the Treasury to construe the changes strictly in favor of the Government and for the disgruntled taxpayer to carry his grievance to court, a procedure which, by the way, has been only slightly affected by the establishment of the new Board of Tax Appeals. Cases under the earliest of the present series of revenue acts are still being considered by the courts. How can the ideal of a fully adjudicated statute be approximated, if new changes, many of them of doubtful legal validity, are constantly made?

Finally, the constant revision puts an intolerable burden on the Bureau of Internal Revenue itself. In some respects we have reason to be proud of this bureau. Considering its task in relation to its resources, its record is probably, on the whole, creditable. But, nevertheless, the administration of the federal income tax law is a shame and a disgrace. It is so bad that T. S. Adams, himself intimately connected with the bureau since 1917, feels free to say that "all is not well with the Bureau of Internal Revenue"; that it is "sick"; "suffering from overstrain"; "staggering and stumbling."[1] As every taxpayer knows, the work of auditing returns is years behind schedule. On the day this is written the Treasury has made public the regulations dealing with the Revenue Act of 1924. The forms are not yet available. Under these circumstances should there be a Revenue Act of 1925?

Our experience with the income tax has been brief and our record has been the very antithesis of stability. Contrast the situation with that in England. England, after an early experience with income taxation during the period of the Napoleonic war, established a permanent income tax in 1842. That tax, in its essentials, is the income tax which is in force in England today. Even the lettering of the schedules remains as established eighty-two years ago. There have been revisions and refinements during these years, it is true, but the changes have been preceded by careful study by royal commissions and when made represented the deliberate judgment of the most competent students in the kingdom. Changes in rates have been frequent, but changes in the fundamental act have been rare.

Seven Revenue Acts in Twelve Years!

In this country Congress established the income tax in 1913. This act lasted three years, being replaced by an entirely new law in 1916. The following year extensive amendments were made, not only in rates but in the structure of the law and of the procedure. This amended act of 1917 lived one year and was superseded by the Revenue Act of 1918. Then came the Revenue Act of 1921. The 1924 law, just passed, was the next step, and before the Treasury has been able to publish the forms and regulations dealing with this law, the Revenue Act of 1925 looms on the horizon. If enacted this will make seven revenue acts in twelve years! Each of the acts passed made extensive and fundamental changes. None of the acts was valid for a longer period than three years.

Or, compare our record with that of England regarding excess profits taxation, which is a variety of income tax. The British chose their course and held to it consistently. It was only about a year after the war began that they established their excess profits duty, but even at that early date, and without the benefit of precedents in their own or any other country, they established it in a form which they found unnecessary to change in any important particular during the period of its application. When abolished in 1921 they had essentially the same scope of application, the same definition of profits, the same standard of excessiveness, the same rules for calculating invested capital and the same general procedure, that they had at the beginning. Our story is entirely different. We first passed an excess profits tax law early in 1917, and even before it became fully effective replaced it with another in October of the same year. We began with a law of broad application and then swung to the opposite extreme of very narrow application. We began with an invested capital standard; the next year we substituted an alternative standard and the third year reverted to the first type once more. We tinkered with the definition of profits and made important changes in procedure. The British contented themselves with mere changes in rates to meet varying fiscal needs.

Except for its rates, the Revenue Act of 1924 bears a remarkably close resemblance to the original Mellon Bill. It is far from perfect but its really serious faults cannot be amended by tinkering. The next revenue act, when it comes, should, for example, provide a solution of the present inequitable situation as between corporations and individuals. Who will maintain that such a solution can be evolved without long preliminary study? We should learn that to change a rate it is unnecessary to write an entirely new revenue act. We should learn that adequate preliminary consideration pays big dividends.

[1] *Proceedings* Academy of Political Science, May, 1924, pp. 24, 25.

Company Reports

Chief Consolidated Mining Co.

Silver, lead; Eureka, Utah

A report of the operations of the Chief Consolidated Mining Co. for the third quarter of 1914 states that pending the final completion and successful operation of the new concentrator the directors have decided to pass the Nov. 1 dividend.

The operation of the flotation department of this concentrator, which has been working for about two months and is effecting a profit on the ores formerly too poor to mine, as well as winning added profit on ores formerly shipped direct to the smelters, is also measurably confirming anticipations that in treating profitably the poorer ore which formerly it was impossible to mine, it is promoting the development of the better grade of ores which might never otherwise be found, or the finding of which could be brought about only by expensive development work.

The total shipments of ore were 30,054 tons, dry, yielding after smelting, transportation, sampling and all operating charges, $104,651.86.

Metal Contents

Gold, oz.	3,376
Silver, oz.	715,663
Lead in lead ores, lb.	4,704,278
Copper in copper ores, lb.	188,563

Balance sheet as of Sept. 30, 1924 follows:

Assets

Property		$3,949,407.40
Mine investments (at or below cost)		612,195.60
Current assets	$138,871.70	
Subsidiary companies' balance	245,280.83	
Inventories	23,408.50	
Miscellaneous	7,290.06	
		414,851.09
Liberty bonds investment		435,538.69
Cash		67,863.76
		$5,479,856.54

Liabilities

Capital stock		
1,500,000 shares at $1	$1,500,000.00	
Less stock in treasury	500,000.00	
		$1,000,000.00
First-mortgage bonds		750,000.00
Stock premium	$215,020.32	
Less bond discount and expense	50,691.61	
		164,328.71
Surplus, January 1, 1924	$2,572,477.63	
Profits		
Gross receipts from sale of ore, lime products, and other material	$1,514,841.48	
Less operating	1,388,307.04	
Net earnings	$126,534.44	
Interest on investments and deposits	22,554.88	
	$2,721,566.95	
Less dividends No. 39 and 40	199,275.80	
		2,522,291.15
Current liabilities		138,590.32
Reserve accounts:		
Reserve for taxes	$625,607.63	
Reserve for depreciation	278,984.68	
Reserve for hospital fees	54.05	
		904,646.36
		$5,479,856.54

Tomboy Gold Mines Co., Ltd.

Gold; Colorado

A report of the operations of the Tomboy Gold Mines Co., Ltd., for the year ended June 30, 1924, shows a realized profit of £15,657 5s. 10d., but there has to be provided for British taxation £2,600, leaving a credit balance of £13,057 5s. 10d. Adding to this the credit balance of £12.495 12s. 3d. brought forward from last year, there is a total to credit to profit-and-loss account of £25,552 18s. 1d.

The usual provision for depreciation has not been made this year. In the present circumstances of the company the directors do not consider it necessary to use the profits for this purpose, and they recommend the payment of a dividend of 9d. per share, free of income tax, out of the £25,552 18s. 1d. shown above, absorbing £11,625, and leaving a balance of £13,927 18s. 1d. to be carried forward to credit of profit and loss.

A total of 215,597 tons of ore has been milled, yielding $755,416.93. Costs amounted to $688,906.02, leaving a profit of $66,510.91. Adding to this the sundry profits and royalty brings the total to $75,504.23.

The working costs for the year, at the mine, were $3.19 per ton.

The figure of ore reserves is 215,062 tons, equal, at the present rate of operation, to one year's supply of ore for the mill,

A total gross of 236,352.6 tons of ore was hauled from the mines to the mill. From this total 9,550.8 tons, or 4.04 per cent, was sorted out at the mill and discarded as waste, and 11,006.0 tons, or 4.85 per cent, was deducted for moisture content, leaving, with a gain in bin storage of 198 tons, a net total of 215,597.8 dry tons milled.

Revenue and Expenditure

Year to June 30, 1924

Dry tons milled, 215,597.8, yielding bullion worth			$176,231.69
Concentrate worth			579,185.24
			$755,416.93
Sundry profit, boarding house and rents			5,660.07
Royalty (from leasers)			3,333.25
			$764,410.25
Mining and development expenses	$1.38 per ton	$296,603.00	
Milling expenses	.59 per ton	126,883.55	
Concentrating expenses (including transportation to railway)	.60 per ton	130,353.81	
Water supply expenses	.16 per ton	36,137.74	
Assay office expenses	.03 per ton	6,350.67	
General expenses	.27 per ton	58,307.39	
Taxes and insurance	.16 per ton	34,269.86	
Total expense	$3.19 per ton		688,906.02
Profit			$75,504.23

November Mining Dividends Total Higher as Metal Prices Advance

The following dividends were paid by mining and metallurgical companies during November:

Companies in the United States	Situation	Per Share	Total
Alaska Treadwell Gold	Alaska	$1.00 L	$200,000
American Smelting & Refining	Various	1.25 Q	762,475
Arizona Copper	Ariz.	9d. SA	56,997
Cardiff Mining & Milling, s, l	Utah	$0.10 I	50,000
Colorado Fuel & Iron pfd	Various	2.00 Q	40,000
General Development	Various	0.25 Q	30,000
Great Western Mining, g	Nevada	0.01 I	13,300
Homestake Mining, g	S. D.	0.50 M	125,580
International Nickel pfd., n, c	W. Va., Ont.	1.50 Q	135,689
Miami Copper	Ariz.	0.50 Q	373,557
New Cornelia Copper	Ariz.	0.25 Q	450,000
New Jersey Zinc	Various	4.00 QX	1,818,656
Union Copper Land & Mining	Mich.	0.50 I	40,000
U. S. Steel pfd	Various	1.75 Q	6,304,919
United Verde Extension, c	Ariz.	0.50 Q	525,000
Companies in other countries			
Amparo Mining, g, s	Jalisco	0.02 Q	40,000
Aramayo Mines of Bolivia, s, t, b, c	Bolivia	1.50 Q Swiss francs	900,000
Cerro de Pasco, c, s	Peru	$1.00 Q	$898,230
Hollinger Consolidated Gold	Ont.	0.05 4wks.	246,000
Total			$12,053,406

s, silver; l, lead; g, gold; n, nickel; c, copper; t, tin; b, bismuth; L, liquidation dividend; Q, quarterly; SA, semi-annually; I, irregularly; M, monthly; X, includes $2 extra.

The total of dividends paid in November is about $1,163,000 more than was paid in August for the corresponding quarterly period, and $143,000 more than was paid six months ago. New Jersey Zinc paid its first extra dividend in five years, reflecting the increasing prosperity of the zinc industry. Cardiff followed its October dividend by paying another of the same amount in November. Great Western Mining, a small high-grade gold property in lower Rochester, Nev., paid its second dividend, and Union Copper Land & Mining repeated the dividend paid last December. The Bolivian Aramayo mines, where most of the world's bismuth comes from, increased its dividend from 1.25 to 1.50 Swiss francs. Alaska Treadwell paid a dividend out of liquidation proceedings.

The only company to reduce or pass its dividend was Chief Consolidated, which decided to husband its resources "pending the final completion and successful operation of the new concentrator."

Current Prices of Mine Materials and Supplies

RISE AND FALL OF THE MARKET

Advances are in excess of declines in prices of mine materials and supplies. The upward trend is particularly noticeable in steel structurals, lumber, rope, railroad spikes and paint materials. Some weakness, however, still exists in c.-i. pipe, hollow tile, wire nails and lime. The cost trend, particularly in construction materials, has been downward since May of this year. The present level is about 0.6 per cent above that of the first week in November.

SHEETS—Quotations are per 100 lb. in various cities from warehouse also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	St. Louis	Chicago	San Francisco	New York
No. 10	$2.60@2.70	$3.90	$3.80	$3.95	$3.89
Black No. 28	3.40@3.50	4.65	4.50	5.00	4.60
Galvanized No. 28	4.50@4.60	5.65	5.50	5.90	5.60

STEEL RAILS—The following quotations are per ton f.o.b. Pittsburgh and Chicago for carload or larger lots:

	Pittsburgh Current	Pittsburgh One Year Ago	Birmingham	Chicago
Standard bessemer rails	$43.00	$43.00	$43.00	$43.00
Standard openhearth rails	43.00	43.00	43.00	43.00

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh Current	Pittsburgh One Year Ago	Chicago	St. Louis	San Francisco	Birmingham
Standard spikes, ⅜-in. and larger	$2.70@$2.80	$3.15	$3.45	$3.75	$4.35	$3.72
Track bolts	3.75@4.00	4@4.25	4.45	4.65	5.85	4.57
Standard section angle bars	2.75	2.75	3.40	3.40	4.00	3.20

STRUCTURAL MATERIAL—Following are base prices f.o.b. mill, Pittsburgh and Birmingham together with quotations per 100 lb. from warehouses at places named:

	Pittsburgh, Mill	Birmingham Mill	New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in.	$1.80@2.10	....	$3.34	$4.15	$3.25	$3.10	$3.00
Channel, 3 to 15 in.	1.80@2.10	....	3.34	4.15	3.25	3.10	3.00
Angles, 3 to 6 in., ¼ in. thick	1.80@2.10	....	3.34	4.15	3.25	3.10	3.00
Tees, 3 in. and larger	1.80@2.10	....	3.34	4.15	3.30	3.10	3.05
Plates	1.75@1.90	....	3.34	4.15	3.25	3.10	3.00

WIRE ROPE—Discounts from list price, f.o.b. New York and east of Missouri River, on regular grades of bright and galvanized are as follows:

Cast steel round strand rope	20%
Galvanized steel rigging and guy rope	7½%
Round strand iron and iron tiller	5%
Plow steel round strand rope	35%
Special steel round strand rope	30%
Galvanized iron rigging and guy rope	+12½%

	New York	Cleveland	Chicago
Drill Rod (from list)	60%	55%	50%

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

	Inches	Steel Black	Steel Galv.	Inches	Iron Black	Iron Galv.
BUTT WELD—	..1 to 3	62	50½	1 to 1¼	30	13
LAP WELD—	2½ to 6	59	47½	3 to 6	28	13

STEEL PIPE—From warehouses at the places named the following discounts hold for steel pipe:

	Black New York	Black Chicago	Black St. Louis
2½ to 6 in. lap welded	44%	53%	46%

CAST-IRON PIPE—The following are prices per net ton for carload lots:

	New York Current	New York One Year Ago	Birmingham	Chicago	St. Louis	San Francisco
6 in. and over	$55.60@56.60	$63.60	$44@45	$50.20@51.20	$50.60	$56.00

Nuts—	New York	Cleveland	Chicago
Hot pressed, sq., per 100 lb. Off list	$1.50	$4.00	$4.00
Cold punched, sq., per 100 lb. Off list	1.50	4.00	4.00

HOLLOW TILE—Price per block in carload lots to contractor for hollow building tile.

	New York Current on Trucks	New York One Year Ago	Chicago	Philadelphia	St. Louis	San Francisco	Perth Amboy N. J., Factory
4x12x12	$0.1162	$0.1179	$0.089	$0.125	$0.077	$0.108	.....
6x12x12	.1743	.1769	.114	.....	.103	.156	$0.2388*
8x12x12	.2179	.2211	.163	.215	.14	244	.2956†

* 10x12x12; † 12x12x12

MACHINE BOLTS—½x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 45%.

LUMBER—Prices of rough Douglas Fir No. 1 common, in carload lots to dealers at yards in San Francisco. To contractors, $2 per M. ft. additional.

	6-8 and 12 Ft.	10-16-18 and 20 Ft.	22 and 24 Ft.	25 to 32 Ft.
3x3 and 4	$28.00	$29.00	$30.00	$33.00
3x6 and 8	28.00	29.00	30.00	33.00
4x4-6 and 8	28.00	29.00	30.00	33.00

Wholesale prices to dealers of long leaf yellow pine. To contractors in New York City, delivered from lighters or cars to job, $5 additional.

	New York 20 Ft. and Under	New York 22-24 Ft.	Chicago 20 Ft. and Under	Chicago 22-24 Ft.
3x4 to 8x8	$40.00	$41.00	$	$
3x10 to 10x10	45.00	46.00		
3x12 to 12x12	50.00	51.00		

Other Cities	8 x 8-In. x 20 Ft. and Under Pine	Fir*	Hemlock	Spruce	12 x 12-In. 20 Ft and Under Pine	Fir*
Boston	$56.00	$54.00†	$50.00	$50.00	$67.00	$65.00†
Cincinnati	40.00	74.00	74.00	88.00	44.00	78.00
Denver	.....	35.75	35.75	35.75		36.75
Minneapolis	40.00	38.75	39.00	.....	43.00	38.75
Kansas City	39.50	.....	.....	.....	47.50	.....
Birmingham	.....	.....	.....	.....	.....	.....

* Douglas fir. † Prime.

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh, Mill	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	$2.75	...	$4.20	$4.25	$3.24	$4.95
Cut	2.90	....	5.25	5.00	3.49	5.00

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots *without bags*. Cash discount not deducted.

	Current	One Month Ago	One Year Ago
NewYork, del. by truck	$2.50@2.60	$2.50@2.60	$2.70@2.80
Chicago, f.o.b.	2.20	2.20	2.20
Cleveland, f.o.b.	2.39	2.39	2.46

LIME—Warehouse prices:

	Hydrated, per Ton Finishing	Hydrated, per Ton Common	Lump, per Barrel Finishing	Lump, per Barrel 280-lb. net Common
New York	$18.20	$12.@13.10	$3.75	$2.50@$3.00
San Francisco	22.00		.....	(180-lb. net) 1.60

LINSEED OIL—These prices are per gallon:

	New York Current	New York One Year Ago	Chicago Current	Chicago One Year Ago
Raw in barrel (5 bbl. lots)	$1.11	$0.98	$1.05	$1.14

WHITE AND RED LEAD—In 100-lb. kegs, base price in cents per pound:

	Dry Current	Dry 1 Yr. Ago	In Oil Current	In Oil 1 Yr. Ago
Red	15.25	14.00	16.75	15.50
White	15.25	14.00	15.25	14.00

HOSE—Quotations at New York warehouses:

Fire Protection — 50-Ft. Lengths

Underwriters' 2½-in. coupled, single jacket ..... 56c per ft.

Air—Best Grade

½-in., per ft. ..... 3 ply $0.36 4 ply $0.44½

Steam—Discounts from List

First grade ..... 30–5% Second grade ..... 40–5% Third grade ... 50%

RUBBER BELTING—List price 6-in., 6 ply, $1.83 per lin.ft. for rubber transmission belting.

Best grade ..... 50% Second grade 50-10%

LEATHER BELTING—List price, 24c. per lin.ft. per inch of width for single ply at New York warehouses:

Grade	Discount from list
Medium	40–2½%
Heavy	30–5%

RAWHIDE LACING—For cut, best grade, 45–5%, 2nd grade, 55%. For laces in sides, best, 41c. per sq.ft.; 2nd, 37c. Semi-tanned: cut, 45–5%; sides, 41c. per sq.ft.

PACKING—Prices per pound:

Rubber and duck for low-pressure steam, ½ in.	$0.90
Rubber sheet	.45
Rubber sheet, wire insertion	.70

MANILA ROPE—Per lb., ¾-in. and larger, 1,200-ft. coils.

Atlanta	$0.19½	New Orleans	$0.21½
New York	.18½	Seattle	.17
Chicago		San Francisco	.21

EXPLOSIVES—Prices per pound of dynamite in small lots:

	Gelatin 40%	Gelatin 60%
New York	$0.27	$0.295
Minneapolis	.1917	.2123
Denver	.2025	.2275
Seattle	.165	19
Cincinnati	.22	245
New Orleans	.235	.29
San Francisco	.1625	.1925

FLOTATION OIL—

Pine tar, 50 gal. bbl., gross weight 500 lb., f.o.b. New York, carload lots, per gal.	$0.30

CHEMICALS—

Zinc dust, 550 lb. casks, f.o.b. Palmerton, Pa., per lb.	$0.08½
Litharge, f.o.b. New York, kegs, per 100 lb	14.85
Sodium cyanide, 220 lb. single case lots, f.o.b. New York, per lb.	.19@.22

Mining Stocks

Week Ended November 22, 1924

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Alaska-Br. Col.	N. Y. Curb			*10		
Anaconda	New York	39½	38¼	38¼	De.15, Ja.21, Q	0.75
Arcadian Consol.	Boston	1 1/16	1	1		
Ariz. Com'l.	Boston	11½	10½	10½	Jy.19, Jy.31	0.50
Calaveras	N. Y. Curb	2 1/16	2	2 1/16		
Calumet & Arizona	Boston	53½	50½	50½	De.5, De.22 Q	0.50
Calumet & Hecla	Boston	17½	15½	16½	My. 31, Jn. 16	0.50
Canario Copper	N. Y. Curb	4½	4	4½		
Cerro de Pasco	New York	48¼	47½	47⅞	Oc. 23, No. 1	1.00
Chile Copper	New York	34⅜	33⅛	33⅞	De.3, De.29, Q	0.62½
Chino	New York	26¼	24½	24⅞	Sept., 1920	0.37½
Con. Coppermines	N. Y. Curb	3⅜	3¼	3¼		
Copper Range	Boston	27¼	25	25	May, 1923	1.00
Crystal Copper	Boston Curb	*73	*60	*67		
Davis-Daly	Boston	*50	*40	*50	Mar., 1920	0.25
East Butte	Boston	4⅜	4½	4½	Dec., 1919	0.50
First National	Boston Curb	*39	*36	*38	Feb., 1919	0.15
Franklin	Boston	*70	*70	*70		
Gadsden Copper	Boston Curb	*65	*62	*64		
Granby Consol.	New York	17⅞	16½	16½	May, 1919	1.25
Greene-Cananea	New York	15⅝	14½	15½	Nov., 1920	0.50
Hancock	Boston			1		
Howe Sound	N. Y. Curb	2½	2⅜	2½	Ap.1,Ap.15, Q	0.05
Inspiration Consl.	New York	28⅞	27⅜	27⅞	De.20, Ja.7, Q	0.50
Iron Cap	Boston Curb	2½	2	2	May, 1923	0.15
Isle Royale	Boston	17	16	16	Se. 1, Se. 15	0.50
Jerome Verde Dev.	N. Y. Curb	1	*95	1		
Jib Consol.	N. Y. Curb	*45	*38	*40		
Kennecott	New York	50¼	48½	49	Se.5, Oc.1, Q	0.75
Keweenaw	Boston			1		
Lake Copper	Boston	†2½	†2			
Magma Copper	New York	36¼	35	35½	Jan., 1919	0.50
Mason Valley	N. Y. Curb	1⅜	1⅛	1⅛		
Mass Consolidated	Boston	1¼	1⅛	1⅛	Nov., 1917	1.00
Miami Copper	New York	23¼	22¼	22¼	No.1 No.15 Q	0.50
Mohawk	Boston	36¼	35	35	Se. 22, Oc. 13	1.00
Mother Lode Coa.	New York	8½	7⅜	8	Jn. 13, Jn. 30	0.37½
Nevada Consol.	New York	14⅜	14	14⅛	Sept., 1920	0.25
New Cornelia	New York	21⅝	21	21⅛	No. 7, No. 24	0.25
New Dominion	N. Y. Curb			2½		
North Butte	Boston	3¼	2⅞	2⅞	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	1 1/16	1 1/16	1 1/16	No.14, De.2	0.05
Old Dominion	Boston	23⅜	22⅛	23	Dec., 1918	1.00
Phelps Dodge	Open Mar.	†106	†100		Se.20, Oc.1 Q	1.00
Quincy	Boston	24½	22½	22½	Mar., 1920	1.00
Ray Consolidated	New York	15⅞	15	15⅛	Dec., 1920	0.25
Ray Hercules	N. Y. Curb			*19		
St. Mary's Min. Ld.	Boston	37⅛	36	36	Ap.22, My.20	3.00
Seneca Copper	New York	1⅜	1⅛	1⅛		
Shannon	Boston	1¼	*99	*99	Nov., 1917	0.25
Shattuck Arizona	New York	7¼	7⅛	7¼	Jan., 1920	0.25
Superior & Boston	Boston	1⅛	1⅛	1⅛		
Tenn. C. & C.	New York	8⅛	7⅞	8⅛	De.31, Ja.15,Q	0.25
United Verde Ex.	N. Y. Curb	28⅛	27½	27⅝	Oc. 3, No. 1	0.50
Utah Copper	New York	81	79	79	Se.15, Se.30,Q	1.00
Utah Metal & T.	Boston	*25	*25	*25	Dec., 1917	0.30
Victoria	Boston	1	*90	1		
Walker Mining	N. Y. Curb	2⅞	2⅞	2⅞		
Winona	Boston	†*45	†*40			
NICKEL-COPPER						
Internat. Nickel	New York	22	20	22	March, 1919	0.50
Internat. Nickel pfd.	New York			94½	Oc.16, No.1, Q	1.50
LEAD						
Carnegie Lead & Zinc	Pittsburgh	†4⅞	†4			
National Lead	New York	161⅞	156	156	De.12, De.31, Q	2.00
National Lead pfd.	New York	117⅛	116	116⅛	No.21,De.15, Q	1.75
St. Joseph Lead	New York	39¼	37½	37⅝	De. 9, De. 20	0.50
ZINC						
Am. Z. L. & S.	New York	9⅛	8⅛	9⅜	May, 1920	1.00
Am. Z. L. & S. pfd.	New York	32⅜	29⅜	30	Nov., 1920	1.50
Butte C. & Z.	New York	7	6⅞	6⅞	De.10, De.24	0.50
Butte & Superior	New York	18⅛	16⅜	17	June, 1924	0.50
Callahan Zn-Ld.	New York	4	3⅜	3½	Dec., 1920	0.50
New Jersey Zn.	N. Y. Curb	185	176	180	Oc.,No.,'24 QX	4.00
United Zinc	N. Y. Curb			*25		
Yellow Pine	Los Angeles	*70	*70	*70	June, 1924	0.04
SILVER						
Alvarado	Boston Curb	2⅛	1⅞	1⅞		
Beaver Consol.	Toronto	*21¼	*19	*21	May, 1920	0.03
Castle-Trethewey	Toronto	*75	*72½	*74½		
Coniagas	Toronto	2.24	2.10	2.20	Ap.20, My.1	0.02½
Crown Reserve	Toronto	*51½	*48½	*50	Jan., 1917	0.05
Keeley	Toronto	2.24	2.20	2.23	Sept. 15, SA	0.12
Kerr Lake	N. Y. Curb	2⅛	1⅞	2⅛	Oc. 1, Oc. 15,	0.12½
La Rose	Toronto	*8½	*8	*8	Apr., 1922	0.10½
Lorrain Trout Lake	Toronto	1.45	1.40	1.44		
McKinley-Dar.-Sav.	Toronto	*12	*10	*11½	Oct., 1920	0.03
Mining Corp. Can.	Toronto	2.62	2.57	2.60	Sept., 1919	0.12½
Nipissing	N. Y. Curb	6½	6	6½	Oc.1,Oc.20,QX	0.30
Ontario Silver	New York	7	7	7	Jan., 1919	0.50
Temiskaming	Toronto	*19½	*19½	*19½	Jan., 1920	0.40
GOLD						
Alaska Gold	New York	*12½	*12⅛	*12½		
Alaska Juneau	New York	1⅛	1	1		
Argonaut	Toronto	*23½	*22½	*23¾		
Carson Hill	Boston	*65	*40	*65		
Cresson Consol. G.	N. Y. Curb	3 1/16	3¼	3¼	Se.30, Oc.6 Q	0.10
Dome Mines	New York	14½	11¼	13	Oc.3, Oc.20, Q	0.50
Golden Cycle	Colo. Springs			1.31	My.31, Jn.10 Q	0.03
Hollinger Consol.	Toronto	14.80	13.75	14.75	No.13, De.1,	0.05
Homestake Mining	New York	45	41	41	No.2, No.25,M	0.50
Kirkland Lake	Toronto	*24½	*23	*24		
Lake Shore	Toronto	4.00	3.93	3.99	Se.1, Se.15, Q	0.05
McIntyre-Porcupine	New York	15⅜	15	15	No. 1, De. 1	0.25
Newray	Toronto	*24	*23½	*23½		
Portland	Colo. Springs	*48	*48	*48	Oct., 1920	0.01
Teck-Hughes	Toronto	1.18	1.13	1.17		
Tom Reed	Los Angeles	*21½	*20½	*21	Dec., 1919	0.02
Tough-Oakes	Toronto	*39	*34½	*37½		
United Eastern	N. Y. Curb	*38	*38	*38	Jy.18, Jy.31, Q	0.05
Vipond Cons.	Toronto	1.24	1.17	1.20		
Wright-Hargreaves	Toronto	3.80	3.78	3.79	Se.15,Oc.1, Q	0.02½
GOLD AND SILVER						
Black Oak	N. Y. Curb			*89		
Con. Cortez	N. Y. Curb	*12	*11	*12		
Con. Virginia	San Francisco	5⅛	3½	5⅛		
Continental Mines	N. Y. Curb	1¼	1¼	1¼		
Dolores Esperanza	N. Y. Curb			*32	Jy.1, Jy.10 Q	0.05
Premier Gold	N. Y. Curb	2⅞	2½	2⅞	Se. 25, Oc. 30	0.08
Tonopah Belmont	N. Y. Curb	*55	*51	*55	Apr., 1923	0.05
Tonopah Divide	N. Y. Curb	*19	*17	*18	Se. 22, Oc. 10	0.10
Tonopah Extension	N. Y. Curb	3 1/16	2⅞	3⅛	De.11, Ja.1	0.05
Tonopah Mining	N. Y. Curb	1 1/16	1⅛	1⅛	Se.20, Oc.31	0.07½
Unity Gold	N. Y. Curb	*95	*90	*90		
West End Consol.	N. Y. Curb	*49	*49	*49	Mar., 1923	0.05
Yukon Gold	N. Y. Curb			*50	June, 1918	0.02
SILVER-LEAD						
Abumada	Boston Curb	6⅞	6⅜	6⅜	Se.16, Oc.2, X	0.15
Bingham Mines	Boston	20⅜	18	20	Sept., 1919	0.25
Cardiff M. & M.	Salt Lake			1	De.16, No.18	0.10
Chief Consol.	Boston Curb	3 1/16	2⅜	3⅛	Ap.19, My.1,Q	0.10
Columbus Rexall	Salt Lake	*24¼	*23	*24¼	Aug., 1920	0.03
Consol. M. & S.	Montreal	48½	45½	45½	Jn.30, Jy.15	0.75
Daly Mining	Salt Lake			2.00	July, 1920	0.10
Eruptcon	Boston Curb	2⅛	2 1/16	2⅛	Se. 15, Oc. 2, X	0.15
Federal M. & S.	New York	15¼	15¼	15¼	Jan., 1909	1.50
Federal M. & S. pfd.	New York	55⅜	54½	54⅞	No.25, De.15,	1.75
Florence Silver	Spokane	6⅜	5	6½	Apr., 1919, QX	0.01
Hecla Mining	N. Y. Curb	10	9⅜	9⅞	No.15, De.15	0.25
Iron Blossom Con.	N. Y. Curb	*28	*28	*28	Oc.25, 1924	0.02½
Marsh Mines	N. Y. Curb			*5	June, 1921	0.02½
Park City	Salt Lake			4.65	Se. 15, Oc. 1	0.15
Park Utah	N. Y. Curb			3½	Mc. 15, Ap. 1	0.15
Prince Consol.	Salt Lake	*10	*8	*10		
Silver King Coa.	Salt Lake	5	4.85	4.95	Oct., 1924	0.15
Silversmith	Spokane	*29½	*28	*28	Oc. 1, Oc. 10	0.01
Tamarack-Custer	Spokane	1.42	1.35	1.35	Se. 22, Se. 29	0.25
Tintic Standard	Salt Lake	8.50	8.30	8.50	Se.1, '24, X	0.25
Utah-Apex	Boston	3	2⅛	2⅛	Se.5, Se.15, Q	0.25
IRON						
Bethlehem Steel	New York	45¾	44	44⅞	Jn.1, Jy.1, Q	1.25
Char. Iron	Detroit	*33	*30	*33		
Char. Iron pfd.	Detroit	*72	*70	*70		
Colorado Fuel & Iron	New York	42⅛	37½	38⅛	Au.11, Au.25,Q	2.00
Col. Fuel & Iron pfd.	New York			108⅝	No.10, No.26 Q	2.00
Gt. North'n Iron Ore	New York	37⅝	32½	37½	De.10, De.27	2.00
Inland Steel	N. Y. Curb			4	No.14, De.1, Q	0.62½
Mesabi Iron	N. Y. Curb			2½		
Replogle Steel	New York	16⅛	14½	15⅜		
Republic I. & S.	New York	50⅛	47¼	48¼	May, 1921	1.50
Republic I. & S. pfd.	New York	93½	87	92	De.16, Ja.2, Q	1.75
Sloss-Sheffield S. & I.	New York	76½	74½	76	Se.11, Se.20, Q	1.50
Sloss-Shef. S.&I. pfd.	New York	91	91	91	De.9, De.20, Q	1.75
U. S. Steel	New York	117⅛	114½	115⅝	No.29,De.3, QX	1.75
U. S. Steel pfd.	New York	122⅞	121	121½	No.4, No.29, Q	1.75
Virginia I. C. & C.	New York	45	37	45	De.15, Ja.2	1.50
Virginia I.C.&C.pfd.	New York			77	De. 13, Ja. 2, Q	2.50
VANADIUM						
Vanadium Corp.	New York	28⅛	27½	27½	Jan., 1921	1.00
ARSENIC						
Western Utah Copper	N. Y. Curb	*19	*17	*19		
ASBESTOS						
Asbestos Corp.	Montreal	30	26	30	Se.29, Oc.15 Q	1.00
Asbestos Corp. pfd.	Montreal	70	69	70	Oc.1, Oc.15, Q	1.50
SULPHUR						
Freeport Texas	New York	8⅞	7⅜	8⅞	Nov., 1919	1.00
Texas Gulf	New York	87⅛	82½	87¼	De.1,De.15, QX	2.25
PLATINUM						
So. Am. Gold & P.	N. Y. Curb	4⅞	4⅝	4⅞		
MINING, SMELTING AND REFINING						
Amer. Metal	New York	50	48	48¼	No.19, De.1 Q	0.75
Amer. Metal pfd.	New York			113	No.20, De.1, Q	1.75
Amer. Sm. & Ref.	New York	86¾	83	84	Oc.17, No.1, Q	1.25
Amer.Sm.&Ref.pfd.	New York	106	104	104¾	No.17, De.1 Q	1.75
U. S. Sm. R. & M.	New York	36⅛	35	35	Jan., 1921	0.50
U.S. Sm. R.&M.pfd.	New York	46½	45½	46	Oc.9, Oc.15 Q	0.87

* Cents per shar. † Bid or asked. Q, Quarterly. SA, Semi-annually. M Monthly. K, Irregular. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

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